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WHAT'S INSIDE

The connection started more than 2½ years ago with a singing telegram.

In that tuneful missive, connectivity grun Frank J. Derfler, Jr., expressed a desire to help PC Magazine spread the gospel of connectivity. The result was Derfler's energetic involvement in PC Magazine's long-running and successful series of LAN hardware and software reviews.

Since its inception in November of 1986, the series has covered

everything from media-sharing and zeroste LANs to LANstations and data PBX systems. And the success of this series has led us to be flu poverage of connectivity issues. FC Magazine is pleased to amounce the inauguration of ene branch of the FC Labs dedicated to evaluating LAN, micro-to-maintramer, FC-10-Mac, and other workgroup computing systems, and other workgroup computing systems. Deffere wild discontinue has part rime contributing editor status and lead this effort on a full-time board.

To test-drive the new Lah, we used it to valuate a whole issue's worth of LAN software. Though hardware was once the area of hottest growth in the LAN market, ing software developers to take up the stake. Increasingly, vendors such as Novell, 3Com, and Banyan are porting high-end capabilities, such as sophisticated troubleshooting tools and system fault to light the state of the



Making Connections: Frank J. Derfler, Jr., joins the staff of PC Magazine as its full-time connectivity editor.

Recently, LANs have also begun to attrest specialized software that expoits the ability to the PCs together into opengroupe. Usually having an estimate portference producting and estimate and the coordinate are unique to LANs and help work groups better manage their work from and schoduling. We review these programs in "Workgroup Productivity Boosters."

To a LAN user, the ideal network is completely invisible. He should simply use the services of the network as if they were available from his desktop PC. The network administrator is the person who makes that happen. The final category of product, reviewd in "Administrative Relief for LAN Managers," consists of special tools to lep the administrator find and

This issue r

This issue marks one other turning point. Associate editor Chery! J. Goldberg, who managed and edited the first LAN issue, many subsequent articles in the series, and this issue, will be leaving PC Magazine to help Ziff-Davis start up its new PC Computing magazine.

IC Magazier The Adoptivation Guide of MRE Standard Forward Computing 1950 i FREEL \$500) is published by worthly couple in July and August for \$500.07 to one year CLT and \$50.00 to one years, and \$10 V/bit dates years. Additionally places pict 500 years year for Combin and of other temperocenters. Add There Statistings Co., advisorant Standard Co. (1950) and and calculate calculating Co. (1950) and and calculate calculating Co. (1950) and calcu



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QMS-PS 800 II laser printer

The QMS-PS' 800 II is an 8-page-per-minute laser printer that combines the desktop publishing power of Adobe PostScript' with the superior printer technology of QMS, a leader in printer technology for 10 years. Exceptional paper handling, faster processing speed and a Canon' CXD' print engine with 10.000-page-per-month duty cycle give QMS-PS 800 II the versatility you need on your PC network.

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Frank J. Derfler, Jr./To propel LAN users and administrators to the next higher level of productivity. PC Magazine de votes an entire issue to the software side of workgroup computing92

Networking Acronyms and Buzzwords Frank J. Derfler, Jr./ LANspeak doesn't have to hinder you as you struggle to set up a network or manage an existing one. This initiation into the exotica of LAN jargon will make you more efficient

by helping you gain fluency in

COVER STORY

Workgroup Productivity Boosters Frank J. Derfler, Jr./ Not LAN is configured to run

every product that runs on a optimally as networking software. We review 17 that are, awarding the Editor's Choice to three products that offer top-quality calendaring. electronic mail, and integrated desktop utilities 195



the common language of LANs A Field Guide to LAN Operating Systems

Frank J. Derfler, Jr./ With their multiuser and multitasking architecture, LAN operating systems are the key to accelerated network performance. The PC Labs benchmark tests of 131 AN operating systems will help you choose which product optimizes which

Administrative Relief for LAN Managers Frank J. Derfler, Jr./ Eight software products for network

managers pick up where network operating systems leave off, furnishing specialized administrative means for coordinating and auditing the activities of multiple users 247

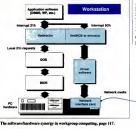
application......117 A Decision Guide for Networking Software 120 Summary of Features Table Benchmark Tests

EDITORIAL PRODUCT INDEX A complete list of products

reviewed in this issue, plus a quick reference to utilities. programs, and tips in the Productivity section...... 430

Cover Photograph: Roberto Brosan

Utilities for LAN gement track data low and more, page 247.





FIRSTLOOKS

Hands On:

- . Three new Dell machines offer speed, performance, and aggressive prices
- · 386 version of Paradox · GrandView brings a new
- view to outlining software · A fast 386 from Everex
- . CAE/SAR 386II: the firstproduction 25-MHz 386 PC · Pixie: Full-featured
- graphics, reasonable price · Time Line upgrade adds outlining feature
- . DesignCAD goes 3-D . New on the Market:
- Tanestry II networking. Orchid's 8MB RAMQuest

memory board. · Pipeline:

The latest software best-seller list, plus Sun's microcomputer strategy33

AFTER HOURS

Encounters of the On-line Kind: Meet new people, make new friends with CB simulators on CompuServe. GEnie, and The Source. We

tell you where the action is. Seeing Stars on CompuServe: Astroforum brings the world of astronomy to your PC

PRODUCTIVITY

PC LAB NOTES

Advanced Graphics in BASIC

Ethan Winer and Brian Gieds/ Produce attention-setting animation and tiling using Turbo Basic and QuickBASIC . 279

UTILITIES

COMPARE Simplifies File Matchups

Michael J. Mefford/ COMPARE takes the time and tedium out of finding differences between two versions of a file 297

USER-TO-USER

POWER USER

records in dBASE:

LANGUAGES

point-plotting with

EGA_GRAPHICS:

errors

PC TUTOR Robert L. Hummel/ Coping

minimizing BASIC's

cumulative calculation

with the wear and tear of the

power on/off cycle; making

CONNECTIVITY CLINIC

peer-to-neer networks while

keeping them cost-effective

newer ATs boot up with NumLock off and cursor keys

working

Frank J. Derfler, Jr./ Increasing performance on

and flexible

Paul Somerson/ Save time and

paper by controlling the Shift-

printing only the portion of the

screen that you select 353

PrtSc key combination and

Craig L. Stark/ Emulating

WordStar commands more

efficiently; editing multiple

microspacing with WP 361

Robert L. Hummel/ Simulating

structured function returns in

Turbo Pascal; speeding up

PC MAGAZINE HELPETLE

ENVIRONMENTS

IBM's OS/2 Programming Tools Charles Petzold/ IBM's poor

documentation and programming tools may hamper OS/2's success 321

POWER PROGRAMMING Converting ASCII Time and Date Strings

Ray Duncan/ Here are two MASM routines that let you convert ASCII time or date strings into binary 335

SPREADSHEET CLINIC Douglas Cobb and Steven Cobb/ Using the same macros in different worksheets with Symphony; converting numeric test scores to letter grades . 349



The universe on-screen: pictures of space from CompuServe, page 440.

LETTERS TO PC MAGAZINE.

PC ADVISOR

Mitt Jones/ Intelligent devices that ease the frustration of sharing one printer over a distance of up to 100 feet, and surface analysis programs that find problem areas on your hard disk

BILL MACHRONE



IOHN C. DVORAK Repent! The End Is

Near Inside Track. IIM SEYMOUR

Semiconductor Blues: Time STEPHEN MANES CD-ROM 1988: Déià Vu All

Over Again85 Direct Marketing

Connection ... Advertisers' Product

Reader Service Card ...431 Coming Up435 ex to Advertisers...439



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That's because the idea of a memory resident spreadsheet makes sense, one that you can pop-up instantly while working in your word

Fi for help or Fig for menu

way we dreamed a spreadsheet would function. Everyone who has seen it

says things like, "Lucid 3-D is how software of the 1990's will look and perform" or even more to the point 'This is the way ! thought a computer 12 04am Jan 1, 1989 Fi for help or Fi8 for menu

should work".

see, Lucid

is exciting.

You'll

way. Users say "It is so intuitive that I real ly don't need a manual." That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "If there ever was an interface idea so good it ought to be stolen and widely used, this is it."

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nize than it is to remember. As choices are made on a menu that take you to lower levels you always can see

What Makes it so Special In the screen examples you can see Lucid

is really multi-dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show And you don't have to write formulas to do that. All you do is go look at the

through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that

other file, navigating

exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it

FIG. 2 Here we are instantly. Notice the lower left corner showing we are on level 2. You can go wn or up. (See next page) processor or any other program.

Lucid lets you cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Lucid 3-D was developed over the past two years with countless, exhaustive hours of planning and programming to produce something spectacular. This is a product that works the

that you can access with a single key.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 400 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write



FIG. 4. Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level If you like.

notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

Speed

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Lucid 3-D is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about. Lucid Learns

Lucid 3-D also lets you teach it any

combinations of keystrokes so that involved sequences

can be. done with single keys. Plus more than just remembering keystrokes. Lucid al-

lows you to create Macros with loops. procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Fi for help or FIG for meno disettains

3 We want more detail, so let's go to papers. Just press the Grey + Key The best idea I've seen for

a spreadsheet in years. lim Seymour, Columnist, PC Magazine, PC Week



Fig. 5. Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many as 3-D levels as you like. No one else cando that.

Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those

you've seen with 1-2-3.



A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often. It really permits that feeling of be-

coming one with your work. Lucid 3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid offers five audit displays and printouts. Masterwork

We could go on at great length about all the features and innovations in Lucid, but Lucid is more than a bag of features. What is most important is the pride and craftsmanship that went into its creation. It is a master-

rs of LIGHTNING k speed up software, and EEAK(1979 2555 Accelerator Boa

FIG. 7 Here It is right in Word Perfect (or any word processors Just like you typed it. You can go the other way just as easily.

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work. The overall feel is tight and polished. In fact, Paul Somerson, executive editor of PC Magazine, used one word to describe it, "Slick".

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Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D without having to upset your present systems

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LETTERS TO PC MAGAZINE



MAKING WORD FTT

In your recent Toshiba T1000 review ("Planes, Trains, and Automobiles: 12 Portables for the Road," PC Magazine,

March 29, 1988), this quote intrigued me: " . . . even disk-bound programs like Microsoft Word take on new laptop life when you install



them on the T1000's RAMdisk I have been using Word 4.0 on my IBM PS/2 Model 60, but the program is too big

to transfer to my T1000. Since I love the Word program, I would greatly appreciate your explaining how to modify it for the T1000's RAMdisk.

Lawrence B. Labovitz Los Angeles, California

You're right that Microsoft Word-as installed on your Model 60-is too large to fit on the Toshiba T1000's 768 Card's RAMdisk. However, you can run Word on a machine with much less disk capacity by creating a copy using Word's SETUP proeram and telline it that you're usine a machine equipped with two floppy disks. When you're done, you'll have separate disks for Word itself, the Word spelling checker, and the Word thesaurus. Then, all you need to run Word on the T1000's RAMdisk are the files on the Word flongy

It's actually just as easy to create a version by copying the WORD.COM, MW.PGM, and MW.INI files and a printer driver file to the 768 Card. Carry the spelling checker and thesaurus floppies with you if you need them .- Ed.

SHARK ATTACK

Although John C. Dvorak doesn't elaborate on the title of his column "Like a Shark: Move Forward or Die!" (PC Magazine, March 15, 1988), it leads one to make the common (incorrect) assumption that sharks must keep moving forward or die from asphyxiation. In the past, the belief held that sharks must continually be on the move to keep water passing over their gills so they could breathe. However, some time ago Jacques Cousteau proved this theory to be untrue.

Paul K. Pagel Enfield, Connecticut

Thanks. When we do the sequel ("Shark II''), we'll call you instead of Roy Scheider .- Ed.

GRAPH GRIFF

Jim Seymour is to be commended for his discussion of Edward Tufte's book The Visual Display of Quantitative Information ("Business Graphics Software: At the Top of the Charts," PC Magazine, March 15, 1988). Tufte's message is, essentially, that what is commonly known as "presentation graphics" is often more accurately described by adding "misre-" as a prefix.

Apparently, however, neither Mr. Sevmour nor Mr. Tufte were heard by the other contributors, who judged the graphics programs largely on the ease with which one can produce chartjunk. Good graph, Charlie Brown!

> Russell V. Lenth lowa City, Iowa

I was pleased to see Jim Seymour's sidebar "Getting Rid of Chartjunk." Mr. Seymour quotes Tufte blasting the use of fake perspective and citing its use in "the world

of Boutique Data Graphics." This quote is particularly appropriate to your own recently redesigned graphics, which are firmly in the boutique category. But given how much it must cost to design and produce those snappy-looking graphics, I suppose I must accept the fact that they will be around until the next major design overhaul. When that time comes, keep Tufte's book close by for easy referral.

John S. Abrams Cambridge, Massachusetts

Jim Seymour's sidebar "Getting Rid of Chartjunk" gave high praise to Edward Tufte's book on the elimination of chartjunk. No Tufte alumnus could ever draw anything like PC Magazine's pseudo-3-D comparison graphs.

Charles Lave Irvinc, California

PC Magazine's charts, while dense, live within the letter of Tufte's rules. We think it's important to portray results by test as

well as by product. Three-dimensional charts serve this need. The data table | MoeFour | 101715 fulfills the informational needs of the left brain, while the



DVORAK'S CARFLESSNESS

"cityscape" makes

it easy for the right

brain to spot espe-

I have to admit it-when John C. Dvorak steps in the cow pasture with both feet, he does it with élan and style; he and his copy editor need to become acquainted with Strunk and White's Elements of Style.

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■ LETTERS

The cow pasture in this instance is Mr. Dvorak's column "The Big Lie" (PC Magazine, March 29, 1988), in which he twice uses the phrase, "Users . . . could care less." This phrase implies there is room for even further disinterest, when in fact he really meant that they "could not care less"; they're as uninterested as they'll ever be.

Richard H. Gleick Maitland, Florida

Mr. Dvorak told us he's not interested in "comments from self-appointed editors who have no real information to contribute to his readership." In fact, he said he

 When John C. Dvorak steps in the cow pasture with both feet, he does it with élan and style.

"could care less." (He also called Strunk and White a couple of word fascists.) Ed.

DIVINE INSPIRATION Although I appreciated your review of the

Bible concordances in After Hours (PC Magazine, March 29, 1988), I totally disagree with your comments about wishing that the Apocrypha were included. There is a major difference between "historically П important" and "inspired by God." The books in the Apocrypha do not meet several tests of inspiration which the 66 books of the Bible meet. I don't want to do a word search that mixes God's inerrant, infallible words with books that, in some cases, contain nothing more than legends. Lvnn A. Gerie ı

Monroeville, Indiana

A ONE-LINE OFFER In light of hypertext's hyperbole, the time

seems right to follow Bill Machrone's advice and offer a one-liner ("Critical Mass," PC Magazine, March 29, 1988). How about "Hypertext: fancy footnotes in their infancy"? It may not compare with Henny Youngman, but it certainly is an improvement over "Hypertext: a way to connect ideas you'd rather forget."

Warren Stringer Santa Cruz, California

THE MAIL-ORDER CHOICE

It seems as though PC Magazine is touting mail order as the method of choice to purchase a computer as well as software and accessories. Although I agree that mail order is not a bad choice for some people, PC Magazine is highlighting it at the expense of full-service dealers.

In particular, I would like to mention Stephen Manes's column "In Praise of Mail Order" (PC Magazine, March 29, 1988). Believe it or not, Mr. Manes, a computer dealer has it rough, and most do care if they've provided a solution for their customer. I am sorry if you've had difficulty with some dealers. But this is no cause to recommend mail order to your readers as the best choice.

J. Barry Christian, Jr. Augusta, Georgia

I would like to take exception to Stephen Manes's column "In Praise of Mail Order." I happen to be one of the "bozos who minds the store for a small business." Contrary to Mr. Manes's statements, I and my co-workers are not novices, nor does my sole interest lie in pushing "whatever product comes with spiffs" (few products come with spiffs).

It may well be true that many of the mail-order houses have offered Mr. Manes excellent support and service. And it is true that we have our share of companies that employ an underqualified sales and support staff. However, I would ask that Mr. Manes not group us all together. There are still some of us who know our business and our products and who pride ourselves on the job that we do. Brad Rogers

Blacksburg, Virginia

I would like to commend Stephen Manes on his column "In Praise of Mail Order." After having waded the river of ignorance that flows from the mouths of retail salespersons (at both large and small chains), I have found mail order to be the only viable source for purchasing my computer equip-



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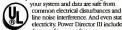
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■ LETTERS

ment. Thank you for giving the concept of mail order a little more dignity.

Kenneth N. Harpster Parkland, Florida

JUST THE FACTS

In Bill Machrone's column "One Million PS/2s" (Bill Machrone, PC Magazine, February 29, 1988), you implied that IBM is somehow manipulating the number of machines being shipped. Either you have a fundamental misunderstanding of our industry, or you simply refuse to accept the facts

Here are those facts again. Through the end of January, IBM had shipped 11/2 million PS/2 machines. As a manufacturer, we speak only in terms of shipments, not end-user sales, and we have never claimed otherwise. That means 11/2 million systems have left our manufacturing floor, most headed for dealer locations. Certainly, dealers keep a limited number of systems in inventory, but they quickly move the vast majority on to end users. If they didn't, it is highly unlikely they would be reordering at such record-breaking rates.

er the Models 25 and 30 are legitimate members of the PS/2 family. With all due respect, that seems like a call that we, not you, should make. In April 1987, we announced the PS/2 line, a new family of products with a variety of capabilities and features. Among those features are 31/2inch diskettes, improved graphics, and advanced functions integrated onto system boards. Such features are common to all members of the PS/2 family, including, of course, the Models 25 and 30.

In the same article, you question wheth-

Charles B. Holleran Group Director, Communications Operations IBM Corp.

Rye Brook, New York

A MATTER OF TIME Regarding Bill Machrone's editorial "Stealing a March" (PC Magazine, March 15, 1988), I would like to take issue with the general impression that Just-in-Time materials management is applicable exclusively to a manufacturing environment. The whole theory of JIT stresses that materials will be ordered only at the time and in quantities in which they are needed.

With the high costs of maintaining inventories, to whom could this concept be more important than the inventory-intensive distributors and service centers? These inventory-heavy centers are running out of time to switch to Just-in-Time.

Rand Crawford Hales Comers, Wisconsin

CORRECTIONS/AMPLIFICATIONS

Kingdom Age Software's God Speed program (After Hours, PC Magazine, March 29, 1988) is available from Paraclete Software, 1000 E. 14th St., #425, Plano, TX 75074; (214) 578-8185.

Presentation Partner, the software included with Computer Accessories Corp.'s Data Display ("Presenting . . . Real-time Overhead Displays for the Big Screen," PC Magazine, March 15, 1988), is not copy protected.

A Communiqués item on a training program of Data-Tech Institute, Clifton, New Jersey-"Exchanging Data Between Lotus 1-2-3, dBase III and other Word Processing Programs"-should have noted that the description was from a newsletter unrelated to Data-Tech Institute (First Looks, PC Magazine, February 16.

The correct name of the IBM product reviewed in "Beyond Native Memory: Addin Boards for PS/2 Models 50 and 60" (PC Magazine, March 15, 1988) is the IBM Personal System/2 80286 Memory Expansion. The correct price of this product, with 2MB, is \$1,044.

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criticism about something you've read in PC Magazine? A question you'd like to open up to other readers? Then send your opinion to Letters to PC Magazine, One Park Avenue, New York, NY 10016, or through MCI mail to PCMAGAZINE.

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and all journals automatically posts from receivables, payables, inventory and payroll so all statements are always current

 automatically displays account descriptions and numbers on screen
 distribute journal entries into multiple revenue or expense accounts, project ects, profit centers or departments m produces full audit trails
m zero balance accounts can be suppressed in reports

■ supports manual or computer produced checks
■ automatically calculates all federal and state taxes, unemployment and disability insurance supports local taxes

automatically posts payroll expenses to General Ledger and Jobcost
 allows seven income fields including pay advance and tip fields
 deducts for taxable benefits

automatically retains QTD and YTD employee earnings, deductions and associated payroll expenses

accumulates 940, 941, W-2 and state tax information

produces immediate employee reports on screen or printer including W-2 forms, employee mailing labels, payroll journals, QTD and YTD reports of earnings & deductions, and employee record reports.

ACCOUNTS RECEIVABLE uses open invoice method to keep track of full or partial payments against

any customer invoices

fully paid invoice may be purged or retained

automatically updates inventory and ledger accounts, and project records
 user can define aging periods

 reports produced on screen or printer including mailing labels, aged sum mary, aged detail and receivables journal automatically displays customer names and numbers on screen when required for program input

m prints computerized invoices or supports manual invoicing m prints computerized customer statements with remittance stubs

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conducted by Price Waterhouse. This is truly a (complete accounting) system. Bedford's six modules...are easy to install, easy to use, and so well integrated with one another that it makes accounting a snap — even for (NYOWORLD judged Bedford as 'superb' and selected it as one of the top products of 1987.

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uses open invoice method to keep track of full or partial payments against

any supplier invoice

fully paid invoices may be purged or retained

automatically updates inventory records, project records and ledger

accounts

accounts

user can define aging periods

produces immediate vendor reports on screen or printer including
mailing labels, aged summary and details, and payables journal
automatically displays vendor names and numbers on screen when required for program input

prints computerized checks or supports entry of manual checks

INVENTORY ■ suitable for manufacturers and wholesalers

m handles state sales taxes updates from receivables and payables

uses weighted average cost method ■ handles adjustments and transfers automatically flags reorder levels

reports can be displayed, printed or exported a expresses selling and cost price to three decimals

JOB COST

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PRINTER SHARING

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We'd like to connect at least one other PC to the printer, but the PC is located about 100 feet away. How can we do this? Gerald A. Ahronheim, M.D. Montgomery, Vermont

Connecting a PC to a printer 100 feet away is no problem—provided you switch from parallel connections to serial. Parallel interconnections offer greater transmission speed than do serial but nowhere near the distance.

You'll also need a printer-sharing device to gather and channel the input of the different PC. Since it sounds as if your office will be expanding use of PC. you should probably opt for a printer sharer than will allow you plenty of growth. You'll also save yourself and your coworkers miles of wulking and fristration if you choose an intelligent printer sharer—one that automatically chooses which print job yoes to the printer at any given time.

The Logical Connection (\$495; Fifth Generation Systems, 269) Richert Ave., #107, Irvine, CA 92714; (800) 225-2775, (714) 333-0111) rates among the molecule and economical of such devices. Each unit allows connection of up to six Pcs—four via serial cable and nov via parallel—and two printers, both through parallel link; You can daisy-thain up to

45 Logical Connections togther for added capacity, though you're probably better off with a full-fledged network if you find yourself leaning in that direction.

Once properly connected and configwred, the Logical Connection will accommendate of the connection will connect the serial signals to paramatically convert the serial signals to part to the printer at any given time. A small constant advertise the small constant of the small constant of the small constant in the small consta

Of course, the Logical Connection isn't the only game in town. You may find that a simpler device will meet your needs. Peruse "18 Ways to Share Your Periphera" in the January 26, 1988, issue of PC Magazine for a look at what the competition has to offer.

 Several utilities on the market will test the surface of your hard disk for marginal areas and block off those areas when it finds them.

RADTRACKS

I sometimes get a DOS disk error—the familiar Abort, Retry, Ignore? message when I try to run my database program. After a retry or two, however, the program runs fine. What's happening, and how do I solve the problem?

> K. H. Starling Salt Lake City, Utah

It sounds as if your database program may be stored on a marginally bad area of your disk. Each time your system tries to read a sector on your disk, DOS allows several retries before you get a disk error message. In your case, sometimes the disk can read the bad sector by the last try: some read the bad sector by the last try: some

times it can't.

Several willilies on the market will test
the surface of your hard disk for marginal
areas and automatically block off those are
as when it finds them. If the data stored on
the bad area is still readable, the program
will move the data to a safe area of the disk
before it blocks off the sector or sectors
from further use.

HDTest, a shareware program, rates among the best of these utilities, primarily because of its exhaustive test of the disk plaiter surfaces. You can download the program from any major bulletin board or send a check or money order for \$30 (\$40 Canadian) to Peter R. Fletcher, 1515 W. Montsomers Ave., Rosemont, PA 19010.

If you'd rather stick with commercial packages, try The Norton Utilities, Version 4.0 (\$100; Peter Norton Computing, 2210 Wilshire Blvd., #186, Santa Monica, CA 90403; (213) 826-8032), or the Mace Utili-

PC ADVISOR

ties (\$99; Paul Mace Software, 400 Williamson Way, Ashland, OR 97520; (503) 488-0224). Both utilities contain competent surface-analysis routines.

WINGS FOR THE EAGLE

I purchased an Eagle PC-2 in the early 1980s. I'd like to upgrade my memory and graphics and add a hard disk. Now that Eagle is out of business, where can I go for products and technical support?

David W. Jones Galveston, Texas

We printed a question similar to this last year. But if the volume of niv Eagle-related mail is any indication, it's time to spread the word again.

Shortly after the Eagle hit the endangered species list, a flock of ex-Eagle employees formed Wilkinson Software (6400 Westminster Blvd., Westminster, CA 92683; (714) 895-1759, (714) 894-3216)

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> David Forsten Spring City, Tennessee

If you don't mind paying for yet another desktop organizer, pick up a copy of

WordPerfect Library (\$129; WordPerfect Corp., 288 W. Center St., Orem, UT 84057; (801) 225-5000). In addition to an impressive calculator with a full, printable tape, you'll get a notepad, phone dialer, calendar, and name and address file.

POLYGLOT ADDRESS

For our overseas readers who want to order Jet:Spell for its 11 foreign-language spelling dictionaries (see PC Advisor, PC Magazine, January 12, 1988), the full company address is Polyglot Inc., 2450 Central Ave., Boulder, CO 80301.

As you may have noticed, your cries for full addresses in PC Advisor-to avoid costly overseas calls-have not gone unheard.

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FIRST LOOKS

High Performance, Low Prices from Three New Dell Desktop Machines

PC HANDS ON

BY JOHN DICKINSON Dell Computer Corp.'s efforts to prove that Texans from Austin do it better than those from Fort Worth or Houston gathered more firepower when the company became the first to announce PS/2-compatible PCs at the same time it introduced a spate of redesigned PC- and

new Micro Channel-based lineup goes one-on-one against IBM's, but the machines won't be shipped until later this year. The new PC-compatibles are being shipped, however. They offer a complete range of wellpriced, well-designed desktop computing power that gives cor-

AT-compatible computers. The

porate PC buyers plenty to think about The Dell System 310 is a 20-MHz 80386-powered machine housed in an ATstyle cabinet and

The high points of Dell Computer's System 310 are its fast 80386 microprocessor, mili hard disk. a wide assortment of graphics and storage options, and price-\$3,799 for a base model.

fast enough to burn the sand off a desert floor. And that's not even the good news: you can buy it with a 40MB hard disk and monochrome display for as little as \$3,799. The System 220 is

powered by a custom-made 16-MHz 80286 chip and priced at

\$1,799 for the base model. Bringing up the rear of the new line is an IBM Model 30 killer called the Dell System 100 that's built around a MultiSpeed 8088 and goes for a mere \$799.

Dell's new flagship System 310 computer is everything you expect from a 20-MHz 386 and more. When it comes to processor performance, this machine stands tall next to any 386 tested to date in PC Labs. The only machine that beats it running the PC Labs 80386 Instruction Mix test is the ALR FlexCache 20386. Dell's 32K static RAM cache performs better than the ALR's, and it runs most system performance tests faster than the Compaq 386/20.

Then there's the System 310's ESDI-controlled CDC hard disk. By 386 standards, its 18-millisecond access time is (continues on page 35)

Paradox Upgrade from Borland Exploits the 80386 Processor

HANDS ON

BY NEIL J. RUBENKING Don't try to run Paradox 386 on an old computer. Nothing less than an 80386-based machine with hard disk, high-density floppy drive, and 1.5 to 16MB RAM will do. Paradox 386.

from Borland International. takes full advantage of the 80386 processor and wastes no effort on lesser machines. Using its own Virtual Mem-

ory Manager, it maps a uniform address space of up to 16MB.

The more extended memory you have, the less Paradox 386 needs to access the disk. There are no overlays-all of the program loads at once and is always available. Internally it uses the 32-bit instruction set, so many operations are more efficient at the very lowest level. You don't need a special operating system.

however-it does all of this under DOS The new Paradox is extremely compatible with Paradox, Version 2.0. You can use existing data and programs with no modification. In fact, you

can mix the 386 version and 2.0 in a network and operate on the same data. The documentation is identical except for a short booklet detailing the differ-

ences. Like most major database packages, Paradox offers a program generation module. Called the Personal Programmer, it designs applications for you based on simple menu choices. The 386 version also updates this module for better performance. As with Paradox itself, the 386 and 2.0 versions

(continues on page 38)

HANDS-ON INDEX

GRANDVIEW A new look in outliners.... 34 JETFONT 123 FONT CARTRIDGE

Tiny type for big spreadsheets

EVEREX STEP 386/20

CAE/SAR 386II The first 25-MHz 386 hits the market46

Great VGA graphics 48 TIME LINE 3.0 The best gets better 54 DESIGNCAD 3-D 3-D drafting for \$300 56

GrandView Outliner Integrates Classic Features and New Tools



BY BARRY SIMON PCs have turned outlining into a major productivity tool. Grand-View, the new outliner program from Living Videotext (LVT), raises the outliner to high art.

Outline programs are useful for organizing ideas, keeping track of to-do lists, and sorting out the kind of information that's more suited to an outline's tree structure than the database/spreadsheet model of rows and columns.

What makes PC-based outliners so powerful is their ability to easily rearrange the structure in new and productive ways.

The top-selling outline program for PCs is also the original one-ThinkTank, from LVT. One of its main competitors has been PC Outline. To bring outlining to a new plateau, PC Outline author John Friend has teamed up with LVT to produce GrandView.

GrandView has inherited qualities from both its parents. Like ThinkTank, GrandView has a variety of organizational tools, including gathering, cloning, hoisting (making a part of the outline into the full displayed outline), prioritizing, and sorting, as well as the moreusual tools to move headlines within the outline hierarchy and to hide subheadlines. The variety of tools is great-

er than in competing products, and they're usually more powerful. For example, ThinkTank limits hoisting to a single headline and its subheads, while GrandView lets you mark and hoist any block of consecutive headlines.

Like PC Outline, Grand-View allows you to load up to nine outlines at once and switch between them with single keystrokes. You can display several outlines on the screen at once in tiled or overlapping windows.

GrandVlew also has PC Outline's easy movement of head-

lines: a single keystroke starts a new headline, and before you type text into that headline, the arrow keys will adjust its posi-

tion in the hierarchy. GrandView's graphic interface has many Mac-like qualities, but it runs in text mode so

ing software. One simple but remarkably illuminating one is to allow you to use different colors for different levels of the outline. With this and a color monitor, the structure of an outline is immediately evident. From the spreadsheet world, it borrows



You can have up to nine outlines open in GrandView. You writch between them with single keystrokes. The pull-down menu lists commands to move around the outline quickly, create templates, customize options, and create and use macros.

slowness associated with such environments. GrandView has drop-down menus that branch to dialog boxes with check boxes and radio buttons. And while a mouse is optional, you'd be silly not to use one, because the program's mouse support is spectacular. Place the mouse cursor on the status line at the bottom of the screen and press the right button, and you'll cycle to the next open outline; press the left button, and the last

Like the other LVT outliners, GrandView places a plus sign in the left margin to indicate that a headline has subheadlines. Double-click on that with the mouse and the subheadlines toggle between being hidden and appearing. Dragging the mouse can either mark a block or move a headline, depending on where you start.

menu you used pops open

GrandView introduces a number of new ideas to outlin-

the idea of named ranges-you there is none of the graphics can name a headline and the name will stick as the position changes

GrandView could be used as a standalone word processor. You can shift any headline into document view, where the material after the first line of that headline becomes all that you work on. GrandView also has the same excellent Microlytic spelling-checking engine as Xy-Write. It's particularly effective when used with the mouse. Printer support is extraordi-

nary. For example, numerous sets of cartridge or downloadable fonts for the HP Laserlet are allowed. You can mark a block and then choose a font for it from a menu, or you can specify fonts by the level of the outline. GrandView's customization features are excellent. You can specify over 40 different colors. It has a standalone utility to re-

define the keyboard com-

mands-there are over 200

functions to which you can assign keys or mouse actions. You have considerable freedom to specify the method of outline numbering, including bullets and semigraphics line characters. You can trade files with ThinkTank, Ready!, PC Outline, and MaxThink, so you needn't lose your previous work (although outlines are limited to available memory).

The extensive tutorial in the manual and superb on-line context-sensitive help make this rich program easier to learn

Finally, GrandView brings project management capabilities to outlining with a device it calls Categories. Think of an outline describing the planning for a large project, which might be organized according to different aspects of the project. You might also want to view the elements by due date, priority, or the name of the person responsible. With GrandView. you can associate any headline to assignments within categories that you set up and then, with a few keystrokes, view the outline in terms of these categories so that, for example, you could see all items for which a given individual is responsible.

If you've used an outline program, you'll be delighted at the power of GrandView. If you haven't, you'll be amazed at what a valuable tool it can be.



Living Videotext Division Symantec Corp. 117 Easy St.

Mountain View, CA 94043 (408) 253-9600 List Price: \$295; special offer through July 31, for registered owners of ThinkTank, \$89; for registered owners of Ready! and PC Outline, \$119.

Requires: 256K RAM, DOS In Short: The best outlining program yet. Not copy protected

CIRCLE 430 ON READER SERVICE CARD

good but not extraordinary When run in its raw state, the disk performs as well as any of its brethren. However, when you install the new version of Multisoft's PC-Kwik disk cache program delivered with the computer, hold on to your eardrums because you've just

launched the Space Shuttle. With the cache installed, the System 310 disk ran the PC Labs DOS File Access test for small records in 5.93 seconds. The Compaq ran the same test at 34,14 seconds and the IBM PS/2 Model 80-111 ran it at 36.79 seconds. The System 310 ran the large record test in 2.88 seconds, which is about three times as fast as the IBM and Compag times.

The System 310 tested here came equipped with the 90MB drive, but you can get it with a smaller (40MB), slower (28ms.) drive, or with a 150- or 322MB drive. The bigger drives are both rated at 18-ms, access times, and the cachine software is available for any of the drives. The only negative thing about the disk is that the one shipped here had about 6MB of



Small footprint and small price tog (\$799) distinguish Dell Computer's System 100 machine.

had sectors on it.

VGA is the video standard of the day at Dell as well as other PC vendors, and the lowestgrade display and adapter combination available is VGA with a monochrome display (as with all Dell computers, you buy the System 310 with a display and adapter installed). The Phoenixwritten BIOS includes logic to remap itself and video BIOS

from ROM (read-only memory) into faster RAM (random access memory). As a result, the video display times when programs use BIOS routines are among the quickest 386 times recorded at PC Labs

The BIOS includes a resident setup program that lets you reconfigure the machine without installing a diagnostic or reference disk. If you're not sure why the machine is performing as it is, just press the hotkey and look at what's going on; if you change anything, you must reboot to make it take effect. You use this program to configure the "compatibility" speed at 8 or 4.77 MHz. Can you think of why you might want to run a 386 at 4.77 MHz? Don't worry, it doesn't actually run quite that slowly.

The base system has IMB RAM on the system board. The system can be equipped with up to 16MB-2MB on the system board and the rest on a special 32-bit expansion card. The one tested here came with 4MB. It was a good thing, too, because Dell shipped its newly released version of OS/2 with it, and if you choose to run the new operating system you'll need lots of RAM. Dell configured its version of OS/2 so you get a choice of running OS/2 and its DOS compatibility box or running

real DOS, in this case Version 3.3. My only serious grine with the Dell System 310 is its mushy, Compaq-like keyboard. Keyboard feel, however, is a subjective issue, and if you like this one you should waste no time in ordering up a System

310. If you don't like this keyboard, order the 310 anyway and shop around for a different keyboard, because you will have to look far and wide to find a better price-performance package for the power user that

is lurking inside you. If you're looking for a computer with the look and feel of the nicely-sized Model 50, but with a decent disk and extraordinary processing power, look no further because the Dell System 220 fits that description. The 220 is powered by a Harrismanufactured 80286 running at 20 MHz, which is just short of the high road in 386 country.

The Dell System 220 runs most PC Labs benchmark tests at speeds nearly mimicking a 386, courtesy of a 286 processor number of

The System 220 runs most PC Labs system benchmark tests at speeds that would make you think you're running a 386. It stumbles a bit when running the conventional memory access test and the unassisted (by an 80287) floating-point instruction mix test, but that's small potatoes when you consider the machine's \$1,799 hase price. That price doesn't include a hard disk or color monitor, but even when you add in the maximum 100MB, 29-ms, disk and a VGA color monitor. you're only talking about \$3,699. On a price-performance basis. IBM's Model

50 doesn't come close to this thing. The system board in the System 220 is about the smallest 286 board I've seen. It includes a single 8-MHz, 16-bit I/O slot used to attach a three-slotted I/O board. The system board design saves a slot by including a Chips and Technologies-based VGA adapter that tested out to be compatible except for the color palette test. The board also has built-in serial and parallel ports. All controller chips used on the

board are C&T-designed. The hard disk in the unit tested at PC Labs is the 31/2-inch, 29-ms., 40MB unit made by Conner Peripherals, which also makes drives used in some Compaq computers. You can also get the System 220 with no disk (why bother?) or with a 100MB drive with the same performance rating as the 40MB unit. In either case, you get the Multisoft disk-caching software that performs so well on the System 310. On the System 220, it takes an average-performing AT-class disk and turns it into a world-class disk competitive with most drives you'll find in 386s.

If size is an issue, you'll love the fact that the System 220 is about 1/2 inch smaller than the Model 50 in all directions. Besides the small system board and hard disk, the small foot-

(continues on page 36) FACT

Dell System 310 Dell System 220 Dell System 100 Dell Computer Corp 9505 Arboretum Blvd

(800) 426-5150 List Price: Dell System 310. with VGA monochrome and 40MB hard disk, \$3,799; with 90MB hard disk and VGA color, \$4,799. Dell System 220, with VGA monochrome and single 31/2-inch floppy disk drive, \$1,799; with 40MB hard disk and VGA color, \$2,699. monochrome and single floppy disk drive, \$799; with 20MB

\$1.600 In Short: Dell's well-priced new Inneup is headed up by the 20-MHz, 386-powered System 310 with a 32K static RAM cache and record-setting disk performance. The System 220 is an 80286 machine with startling 20-MHz performance that's priced like its 12-MHz brethren. The System 100 pits Dell against IBM's Model 30 market with a competent, wellpriced desktop solution.

hard disk and VGA color,

ORCLE 447 ON READER SERVE

Dell

(continued from page 35)

print is assisted by the 31/s-inch microfloppies installed in the front of the cabinet. One I.44MB unit is standard, and a second is optional. The keyboard is the same unit used on the System 310.

Like all new Dell computers, the System 220 has a BIOS written by Phoenix Technologies, which pretty well guarantees you compatibility. Both the system and video BIOS programs can be remapped into extended memory to make them run faster, which is the default when you boot the system.

As good as the System 220 is, I have a problem with it: it's 286-powered in an age when 386 computers are just short of being a commodity item, especially if you measure these things by Dell Computer standards. While the 220's price is competitive with most 12-MHz 286s on the market, it's only \$1,000 short of the price of a minimally (but well-) equipped System 310. Be sure you think about that before you buy, but if 286 power will do, don't pass the System 220 over lightly. If you're going to clone a PS/2, you might as well clone

the most popular model, even

though, by Micro Channel stan-

dards, it's not really a PS/2. At least that's what Dell Computer seems to have had in mind when it designed the System 100. The biggest difference between the Dell and IBM computers is that Dell's clone is priced more ag-

gressively The System 100 is a smallfootprint, turbo-XT-style PC powered by a 9.54-MHz 8088 with a switchable clock that runs the processor at optional speeds of 4.77 MHz (for compatibility) or 7, 16 MHz (for reasons that escape me entirely). The System 100 comes with one or two 31/2-inch floppy disk drives and can also be equipped with a factory-installed 20MB hard card made by Plus

closely than you'd expect in the performance department. Almost all of the PC Labs processor and memory benchmark tests ran at about the same time on both machines. The System 100's Plus disk drive is nominally faster, with a 40-ms. access time versus the Model 30's 80 ms., but runs the PC Labs DOS File Access benchmark tests at slightly slower times. File access times improved by about 15 percent when I used Plus-supolicd utilities to switch

off the screen indicator that

With the clock set to run at

9.54 MHz, the System 100

clones the Model 30 even more

shows when the disk is being accessed. Dell is now considering shipping that utility with the System 100.

The system board is about the tiniest you'll see for an 8088-based machine, powered by an equivalently tiny 30-watt power supply-that's barely enough to run the system and the hard card. The board layout mimics some of the more-clever thinking that went into IBM's PS/2 board designs. In particular, the PC-compatible I/O bus is available in three slots mounted on a dumb I/O board attached to the main board at a 90-degree angle using a standard 64-pin edge connector. The system board includes serial and parallel ports, and it's a good thing

adapter and optional hard card. The System 100 keyboard is not detachable. But it turns out that the configuration works just fine in a machine this small and light, because turning the keyboard to get its angle "just right" doesn't interfere very much with whatever else is on

because the three I/O slots are

quickly filled by the video

your desk The Key Tronic keyboard has a better, clickier feel than I'm used to from either that company or Dell, and I would like it except for Dell's decision to use the truncated key layout that IBM uses on the PS/2 Model 25. It makes for a smaller keyboard-a genuine necessity on this machine-but deprives

you of the separate keypad that I find handy in so many applications. I would have preferred it if Dell had opted for the old 83key layout that is used on earlier

PCs and ATs. Dell ships the System 100 with MS-DOS 3.3 and something called DOS Manager. Written by Microsoft, DOS Manager turns out to be the SAA-compatible DOS shell you'll probably be getting with the next version of DOS Whether it comes with DOS or not, it's one of the better DOS shells you'll see and works well on any of the PCs I tried it out on. If you want a preview, take a look at the user interface on Microsoft Works.

If you like the Model 30-and judging by the numbers, a whole raft of you do-you'll love the Dell System 100. You're not going to want to run Windows but, since the most expensive version with two floppies and the hard disk is only \$1,699, the System 100 is an inexpensive as well as effective deskton solution for users

running standard PC applications.



Benchmark Tests: Dell System 310 and 220

he Dell System 310 holds its own against any 20-MHz 386 we've tested, it runs system performance tests faster than the Compag 386/20. The 20-MHz 286-powered System 220 keeps up with 20-MHz 386s when running most performance

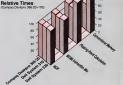
Performance Time (Times given in seconds)	s NOP	80386 Instruction Mix	Floating- Point Calculation	Conven- tional Memory
Compaq Deskpro 386/20	1.65	2.91	10.50	0.40
Dell System 310	1.68	2.85	10.27	0.31
Dell System 220	1.68	2.96*	12.91	0.58
* 80286 Instruction Mix				

The NOP benchmark test is designed to measure ray clock speed and memory access time while minimize differences in microprocessors and the effect of metro ("No Operation") machina code instructions in a big

The 80386 Instruction Mix benchmark test measures the time it takes to execute a selected sense of pro-sor intensive tasks. The test program uses 80386

total processor instruction set. The 80386 Instruction Mix implaments a number of 32-bit operations. In the whereas in the 6086 and 80286 versions of the

The Floating-Point Calculation benchmark test measures processor speed by looping through a ser of floating-point calculations, including multiplication.



Compiler 4 0

Tile Conventional Memory Selections total statement 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,354 random records are read and written from this memory. The result shown is the overage of the read and write times

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If you're stepping up to a Local Area Network, new Enable/LAN just came out on top in a comparison with other integrated LANs in an InfoWorld report: "easier to learn and use...the best integration ...(Enable) simply feels right."

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nearly \$2500. How does that compute?



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Paradox 386

of the Personal Programmer are

completely compatible. Because it ships on highdensity disks, Paradox 386 is compact and installation is quick. There are only two disks for the main program and two will want to either remove those programs or install enough RAM so that you can have plenty of both expanded and extended memory. If possible, give Paradox 386 twice as much ex-

cupies on disk. Paradox 386 doesn't enhance every operation, just

If you are using Paradox 2.0 on a 386, you should upgrade. If you don't have a 386, this program is a very good reason to get one.

more for the Personal Programmer. This is quite a contrast with the 10 to 12 disks and interminable installation of some

other major packages. Paradox 386 does have one specific limitation beyond the hardware requirements mentioned above. Your RAM over IMB must be configured as extended memory. If your current system includes programs that require expanded memory, you

those involving repeated access to large tables. Retrieving data. making ad hoc queries, scrolling through the data set, sorting-all of these will happen faster. However, small operations like editing individual fields or transferring single records to an array won't show any improvement. The same is true for applications-large ones with libraries full of procedures will run faster; small, sim-

Note that the 386 chip can't speed up your printer. You'll want to install a large printer cache so the printer won't slow you down. tended memory as your data oc-As delivered, Paradox 386

is network-ready. If other workstations in the network are running either the 386 version or 2.0, they can share data and applications. Do note that only the 386 workstations will get performance advantages. Paradox 386 is not a "server application"-each workstation runs its own copy.

Borland will soon offer its 386 Network Pack, which licenses you to use the program on up to six workstations linked to a shared data disk. Paradox 386 is a standalone application with network capability-the Network Pack simply costs less than multiple copies of the soft-

ware. The virtues of Paradox 386 become evident only with megabytes of data. It's aimed at the large database user. If you're already using Version 2.0 and have a 386-based machine

available, you should definitely uperade. If you don't have the 386 machine yet, this program is a very good argument for get ting one.



Paradox 386 Borland International 4585 Scotts Valley Dr Scotts Valley, CA 95066 (408) 438-8400

List Price: \$895; upgrade from Paradox 2.0, \$125 Requires: 1.5MB RAM minimum, hard disk and highdensity floopy disk drive

(1.2MB, 51/4-inch or 1.44MB, 31/2-inch), 386-based In Short: A powerful database manager that takes full

advantage of the 80386 microprocessor. Not copy protected.

ORCLE 448 ON READER SERVICE CARD

JetFont Puts More Spreadsheet on Your Page

HANDS ON

BY EDWARD MENDELSON If you're tired of taping spreadsheet printouts together or turning everything sideways so you can get a whole worksheet on one piece of paper, you're ripe for Computer Peripherals' \$325 JetFont 123 Cartridge for the

HP LaserJet. This cartridge enables you to print virtually any spreadsheet on a single page. It comes with four font sizes in landscape and portrait orientations. The smallest packs 30 characters to an inch, which means that you can fit 240 legible characters across a standard 81/2- by 11-inch page and then fill the page with 176 lines. If this does not give you enough spread for your spreadsheet, you can switch to landscape mode and fit 315 characters on a line. Either way, that's four times more data than you can in on a single page with the

JetFont's specially designed Latica type fore fire a lot of your worksheet auto a single printed page while remaining sur prisingly readurer.

LaserJet's resident Line Printer

The JetFont 30-characterper-inch font is surprisingly readable, but you'll want to reserve it for giant spreadsheets. Smaller spreadsheets can use either of the two larger sizes, one at 21 cpi, one at 16 cpi. There's also a standard 12-cpi font that can double as a font for spreadsheets and for text printing, although you shouldn't throw away any Hewlett-Packard car-

tridges you already own. The Lotica typeface in the JetFont cartridge was specially designed by Xiphias for legibility in very small sizes. In a normal size such as 12 cpi, the numbers are beautifully proportioned, but text looks more uneven than it does with conventional typewriter-style or proportional fonts.

The cartridge uses the Lotus International Character Set, so you can use it to print both foreign and financial characters

from Lotus 1-2-3, Symphony, or Manuscript. You can also use JetFont to get readable microscopic printing from any other application, but you will have to spend some time modifying the other application's printer driver.



JetFont 123 Font Cartridge Computer Peripherals Inc 667 Rancho Concjo Blvd. Newbury Park, CA 91320 (800) 854-7600 (805) 499-5751

List Price: \$325 Requires: HP LaserJet or com-

In Short: Four sizes of an ideal font for spreadsheet printing



Disk Optimizer. The original un-fragment software now has un-format. Un-believable! Disk Optimizer is absolutely, positively

It's still the safest, most effective way to out the zip back in hard disk performance. For more than two years now, Disk

Optimizer has helped PC users everywhere safely restore and maintain the smooth, slick, fast performance of their hard disks And now there's a new and improved Disk Optimizer that un-fragments files even

more effectively. And includes enough additional disk management tools to make it one of the best software values anywhere.

So, who needs Disk Optimizer, anyway? Simply everyone who owns a hard disk and relies on the speed and convenience it gives them.

That's because DOS is constantly slowing your hard disk down. It does it by breaking files up into pieces. Storing different chunks in different places. And that makes everything slower - loading, sorting, retrieving, backing up - because your hard disk has to chase all around to read and write different pieces of your file.

Disk Optimizer restores the speed of your hard disk by putting files back together in one contiguous piece - where they belong.

It's sad but true. Some other unfragmenting software could lose your data if something goes wrong in the process. Like a routine reading or writing error. Or even a power failure. But have no fear with Disk Ontimizer.

Nothing will go wrong because nothing can go wrong. Even if you yank the plug from the wall in the middle of the program. It's because only Disk Optimizer copies each file, piece by piece, then checks the newly un-fragmented version for completeness. Only then does it go back and etase the fragmented version. Not power spikes, disk failures or DOS errors-not even earthquakes - can cause data loss. And only Disk Optimizer makes you that promise. So why trust your disk to anyone else?

It's like a precision tune-up for your disk. In addition to un-fragmenting, Disk Optimizer also lets you quickly choose the optimum layout for your disk. So your most-used files have the fastest access. And program and other unchanging files can be permanently un-fragmented and set aside on their own area on the disk. The simple menu makes it a snap.

Un-format - one of the rful new reasons to

buy Disk Optimizer. Oops! Make a simple mistake at the key board and you could wipe out your hard disk with a DOS Format command. But don't worry. "Un-format" will recover your entire disk, and all your data, in just moments. It's

included with your new Disk Optimizer. Plus, you get the new "Analyze" program with a graphical display that shows your disk's condition so you'll always know when it's time to optimize again. You also get "Sorts" for organizing directories for the best appearance and sequence. "Findfile" for searching out hard to find files. "Delfile" for locating and erasing unwanted files. "Lock" and "Unlock" for file security. And more.

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Just a few of Disk Optimizer's rave reviews: Selected PC Magazine's "Best Of The Best" utilities.

I find Disk Optimizer excellent. Disk access, even at 4.77MHz, is much faster. And loading 100 Fontasy fonts now takes seconds. Etzabeth Joan Doyle, Indiana

"I feel this is essential software for anyone with a hard drive." - D. Sorenson, Texaco, Californas

"Easy to install, use, and most importantly, it works!" -Dan Nedsen, General Electric Information Systems, NY

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PIPELINE

TOP TEN SELLERS

f 1987 was the year of the ing data between them. At the LAN, this is surely turning same time, high-powered 386 Lotus 1-2-3 2.01 into the year of integration. The DOS machines are taking over Lotus Development Corp. some of the duties formerly as-Mac and DOS worlds are converging at a breathtaking rate, signed to the big workstations. PC Tools Deluxe thanks mainly to the newly re-That last kind of integration got Central Point Software spectable Mac II, the cascade of another boost in early April when Sun Microsystems rolled applications the two maout its 386i twins-20- and 25chines can share, and Borland International Inc. better means of pass-MHz machines that combine 386 processors with workstadBASE III Plus 1.1 tion-quality video and the abil-Ashton-Tate Corp. ity to run Unix applications. Sun's strategy with these Turbo C 1.5 machines is to break down the Borland International Inc. harriers between the DOS and work-The Norton Utilities Advanced Edition station arenas Peter Norton Computing and to get Learning DOS Microsoft Corp. IN PERSPECTIVE Sideways 3.2 The Top Ten Sellers list ranks PC business programs according to their sales performance in the last week of a 5-Turbo Pascal 4.0 week period. It also tracks programs' rankorland International Inc. ings (reading left to right) from February 22 through March 26. A 5-week history is charted to QuickBASIC 4.0 give a sense of a program's sales strength over time. Microsoft Corn Dramatic shifts in a particular program's ranking may be the result of sales promotions conducted by individual retailers Seasonal factors, such as end-of-year-budget purchase decisions can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list. Rankings are based on net sales by unit; returns are sul tracted from gross Sales information compiled by Ingram Software Inc.

SURVEY

All the talk about OS/2 might make you think DOS is losing popularity. Our latest survey shows this isn't true; only I percent of respondents thought that DOS would lose its dominance within a year, and the majority said it would be 4 years before other operating systems took over.

That doesn't mean nobody cares about multitasking, however. More than half the respondents said it was important, even though 44 percent had no plans to buy the products listed. Is OS/2 what they're looking for? Doesn't look like it: our last question gives an indirect reading on the feeling about OS/2-62 percent of respondents have no plans to buy it.

When will DOS cease to be the standard?

Later than 4 years Within 2 years

Is multitasking Important in a new operating system?

PC MAGAZINE . JUNE14, 1988

Within 3 years

a piece of the DOS profits.

The move has advantages for both sides. The industry has long ignored the fact that technical and scientific users of workstations also need general application programs like spreadsheets, databases, and word processors. The 386i gives such users access to the broad base of DOS programs already in use on PCs. For PC users, the sudden availability of Unix is a gateway to more-powerful applications and connectivity with minis and mainframes. The 1,152 by 960 resolution of the 386i monitor and the 25-MHz speed will thrill workstation neophytes and induce the PC industry to produce more-capable desktop machines

Behind all of this is a company that's soared to the top of the heap in the last year and is now extending its already broad reach to yet another area of the market. The 386i machines stretch Sun's offerings across three distinctly different hardware platforms: the company's 68000-based Unix workstations have been the mainstay of its business, and the newer SPARC (Scalable Processor Architecture) machines-powerhouses that derive enormous processing speed by using fewer

Microsoft Windows

New on the Charts: He Who Hesitates...

The considerable period of stability on the Top Ten Sellers has been broken by a flurry of activity in the last few weeks. We can (finally) bid farewell to the tax packages and get back to the business of applications programs, utilities, and programming languages. And there's plenty of action there.

Looks like software users are getting tired of waiting for the new releases of certain major software programs and are starting to spend their money elsewhere

In the past 5 weeks, Borland's Quattro soared from number 13 to number 3, an ascent almost certainly propelled by the delay of Lotus 1-2-3, Release 3.0. WordPerfect Corp. is suffering for its molasses-in-January progress on the release of WordPerfect 5.0, of which there is still little sign. The program plummeted from its steady number-3 ranking to 11-which drops it off the Top Ten Sellers list

It would be ungracious to gloat over these developments. but if they awaken software developers to the importance of meeting announced release dates, the user community will at least have gained something.

instructions and thus waste less time telling the computer what to do-are another direction for the future. Several prominent computer manufacturers are licensing the SPARC technology that it hopes will be espoused by from Sun to build their own maapplication software developchines; other deals will be announced soon.

And now the 386i's. They make a lot of sense. With only 30,000 Unix computers (from all makers) installed, the need to branch out was obvious. (The company is also trying to broaden its influence in that market by pushing a new windowing interface. Open Look.

ers) How will Sun do in the DOS market? It's a different ballgame with several well-established players, and it's going to take some doing for Sun to get into the lineup. The next few months should be very interesting, indeed.

Meanwhile, Back in Fort Worth...You might be thinking Tandy Corp.'s acquisition of laptop-maker GRiD will mean you'll be able to pick up a sleek new GRiDCase at your neighborhood Radio Shack. Wrong. Tandy will keep the two companies separate and will continue to sell GRiDs only through direct-sales offices. The only overlap may be the integration of the Tandy L1400 into the bottom end of the GRiD product line, which seems like an odd fit, since the lightweight, backlitscreen GRiDLites share a similar market position with the LT1400s.

the deal gives Tandy an entrée to the government contracts that were GRiD's bread and butter. IBM's getting ready to take the wraps off Prodigy, the videotext service which has cost IBM and partner Sears millions in develcoment. For a flat monthly fee of about \$9.50, the service will offer weather reports, movie reviews, and "personalized responses" from "experts" like Jane Fonda and Howard Cosell. -Nora Georgas

Separate distribution or not,

Are you planning to buy one of these multitasking operating systems?

How important is the Presentation Manager in your decision to buy OS/2?



DOS under Una



PC MAGAZINE . JUNE14, 1988

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Everex Debuts Fast, Low-Cost 386 Machine

HANDS ON

BY WINN L. ROSCH Everex Systems' reputation for

making low-cost peripherals might make you expect its first 80386 computer, the STEP 386/20, to be a cut-rate machine. In fact, the only place where Everex skimps is the \$4,699 price. The STEP 386/20 ranks as the fastest 20-MHz PC vet tested, and nowhere does its

quality suffer. That speed is earned with cache memory. The cache is built around a proprietary cir-cuit design, with Intel's 82385 cache controller absent. The cache is scalable-its size varies with the number of memory

banks you fill. Each bank can hold up to four SIMMs (Single In-line Memory Modules). Fill one bank and you get 64K of cache. Load the system board with its capacity of two banks and you will have 128K, as in the evaluation unit. Pile in a 32-bit expansion card with another two banks, and you will have 256K of cache.

either 256K or IMB SIMMs. The basic system fills one bank with IMB: the test system had two. Megabyte SIMMs push system board capacity to 8MB, 16 with the 32-bit slot filled. The SIMMs in the evaluation system were rated at 120 nanoseconds, the static RAM cache

chips at 25 ns. Of the first megabyte, 640K is available to DOS and the rest goes to shadowing ROM and speeding up throughput. The rest of the system's memory is addressed in the extended memory area.

According to Everex, the STEP 386/20's advanced memory management architecture allows it to eache both memory reads and writes. The Everex design keeps the cache and main memory in sync during writing. DMA transfers, and all other memory operations

The STEP 386/20 can be run at 20, 10, or 7 MHz, all with the eache in control. The lower speeds are achieved by dividing down the oscillator frequency by one-half or one-third (the marked 7 MHz is actually 6.67

The ROM is from American Megatrends. The motherboard is built around Chips and Technologies VLSI parts

The STEP 386/20 accommodates an optional hard disk drive in an internal full-height hard disk drive bay and up to three half-height devices in the right-hand bay, all with front panel access. Standard equipment fills the top half-height bay with a 1.2MB, 514-inch floppy disk drive. The evaluation system also held an optional (\$1,000) 80MB Seagate ST-

4096 hard disk drive. The machine's all-white plastic front panel is interrupted only by a smoked plastic sliding door just left of center. Behind it you'll find the control panel, including the expected AT switch and indicator endowment as well as Everex's own

refinements

Three LEDs indicate operating speed; two switches allow turning the internal speaker off and resetting the computer. Above them all is an alphanumeric diagnostic display that's reminiscent of PC's Limited's SmartVu panel but is brighter. FACT

STEP 386/20 Everex Computer Systems 48431 Milmont Dr Fremont, CA 94538 (RIX)) 356-4283 List Price: \$4,699 Requires: Display adapter, In Short: The fastest 20-MHz.

80386-based PC vet tested

CIRCLE 431 ON READER SERVICE CAR tive, and has more digits. The STEP has two 8-bit slots and six with 16-bit connectors. The proprietary 32-bit connector shares an 8-bit slot. Slots are

AT-height and full length. The biggest shortcoming of the STEP 386/20 design is that

the microprocessor and coprocessor chips are buried under the right-hand drive bay, making them hard to



operations. Performance Times

(Times given in seconds except when	e nated)	80386 Instruction	BIOS Disk Seek		
	NOP	Mix	(mtttseconds)		
Evarex STEP 386/20	1.7	2.7	32.5		
IBM PS/2 Model 80-111	1.7	3.2	32.7		
Compaq Deskpro 386/20	1.7	2.9	18.5		

The NOP benchmark test is designed to measure ray clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP (1) n") machine code instructions in a bio 126K loop the time if takes to execute a selected series of processor-intensive tasks. The test program uses operations in the 80386 processor these beco single instructions, whereas in the 8085 and 80286

Relative Times (Compaq Deskpro 386/20 = 100) The 810S Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software

overhead and may not parallel the manufacturer's claimed average access lime. The test program performs 1,000 seeks. The average result is shown in



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CAE/SAR 386II Breaks the 25-MHz Barrier



BY WINN L. ROSCH Look inside the CAE/SAR 386II and you'll glimpse some

of the future of the PC industry. The miracle of the \$4,500 CAE/SAR II is its new 25.MHz 80386-based OEM system board, designed and built by Intel Corp., propagator of the

80386. The new Intel product gives PC designers a quick entree into top-performance computing. Making a miracle machine requires no more technical development than finding screws to fit it into a case-and even that is an easy project because the board fits exactly in the place of

an AT system board. The modest effort is reward-

ing. This board is fast. Based on a real 25-MHz 80386 (not one rated for 20 that just happens to test out quicker during someone's selection process), the Intel board runs with zero wait states 75 to 90 percent

of the time (Intel's figure). Intel has solved another designer's speed problem-get-

up with the fast processors-with a 64K cache that uses 35-nanosecond static RAM chips. The balance of memory

is built from 256K SIMMs, rated at 80 to 100 ns. Strangely, the board does not use Intel's 82385 cache controller, but relies on a wealth of discrete circuitry, some squeezed between the expansion slots

While most makers of highperformance PCs anchor their systems, no matter their processor speed, to an 8- to 10-MHz clock rate on the expansion bus to keep them compatible with earlier generations of expansion cards, Intel provides two new 32-bit slots that run at full microprocessor speed-that's 25 MHz. However, when ordinary 16- or 8-bit cards are plugged into these downwardly compatible slots, they regress to the

same 8-MHz rate controlling the other two 8-bit and four 16bit AT-compatible slots that are available on the board. Imagine this new slot becoming a standard. No current hard disk would be able to keep

tation of the Intel board is based on the standard AT layout with three half-height drive bays and one full-height internal bay

The CAE/SAR II's empty drive bays are covered by unusual blank panels that wrap about an inch around the right side of the computer. The builtout front panel accommodates an auxiliary cooling fan that sucks air from underneath the left front bulge and wafts it gently across the internal expansion area. The cylindrical system and keyboard lock is near the center of the front panel, with power and drive activity LEDs nearby.

The standard I/O portstheir circuitry built into the Intel board-are mounted in a recessed area near the center of the rear of the machine and include a female 25-pin D-shell connector for the parallel port and two male 9-pin connectors for the twin serial ports. The

keyboard connector is also in the center rear. The CAE/SAR II comes with four 256K SIMMs for



CAE/SAR 386H CAE/SAR Systems inc P.O. Box 50243 Palo Alto, CA 94303 (415) 949-3816 List Price: \$4,500 Requires: Video adapter, mos itor DOS In Short: The fastest 80386 on CIRCLE 433 ON READER SERVICE CARE

the high-speed 32-bit slots need to use filled. In addition, the base machine includes a 1.2MR 51/4-inch floppy disk drive and a 40MB hard disk a 101-key keyboard based on the IBM Advanced keyboard design, and a Phoenix BIOS, An 80387 or Weitek 1167 numeric coproces sor is optional.



utes almost nothing but NOF

ocessor instruction set. The 80385 Instruc-tements a number of 32-bit operations. In rocessor these become engle instructi in the 8085 and 80285 versions of the

fonal memory and treats it as a sense of Then, 16,384 random records are read from this memory. The result shown is the



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Pixie Furnishes Cheap, Nearly Idiot-Proof Presentation Graphics



BY BILL HOWARD Pixie may be the graphics equivalent of the studio apartment. Everything in this \$195 Windows-based business graphics program from Zenographics takes place in one room, or in this case, within a single screen. You enter data, create graphs, and change graph types without switching to separate Set Up a Graph, Enter Data, View Graph and Annotate Graph screens, so your graph is never out of sight.

Pixie graphs are mostly composed of what Zenographics calls "smart objects." Pixie automatically increments axis labels if you provide a number, day, month, quarter, or year as the starting point, If you replace the label on the first data point of the X-axis with "Jan." Pixie replaces the following labels with "Feb," "Mar," and so on. Replace "0" with "\$50.00" at the bottom of the Y-axis, and Pixie switches to a currency format with \$50.00 as

the starting point. To create a graph in Pixie,

U.S. Car & Truck Sales

At \$195. Pixic provides most of the features business graphics users need. "Dashboard." at left, provides the eight most commonly used commands.

Pixie provides most of the graphics power you're likely to need. That's a polite way of saying Harvard Graphics, the de facto graphics standard, does a few more things users will need some of the time. Ashton-Tate's new Draw Applause (\$495) may be the closest competitor to Pixie in price and feature mix.

The big difference between Pixie and most other products lies in Pixie's direct manipulation of the graph. To change a bar on a bar graph, you select the bar (click on it with your mouse) and pull the bar up or down. The value changes as the bar height changes. You then repeat the process with the remaining bars.

you start with an existing graph (Pixie provides a default graph with two data series containing four data points each) and replace the data. Pixie uses the standard Windows menu/command bar across the top of the screen and adds a dashboard (Pixie's term) on the left to access the eight most commonly used commands. The dashboard is always visible; you can't do a full-screen preview.

To modify an object, you click on the object and then pick the appropriate modifying tool, for instance, Color, Font, or type/line Style. Examples: To create a third data series in a two-series client, you'd point to the legend for the first or second like Harvard Graphics or Lo-

data set and then click Dupe. To change the Y-axis scale from five segments to four, select a Yaxis tick mark and click Erase.

For complex charts. Pixie's way to adjust values may be slower than working through another program's data entry table. You could change the numbers by typing in a dialog box that pops up when you choose a data point, but it's still bar-bybar editing. More likely, if the chart is complex, you'll create the numbers in Lotus 1-2-3 and import either a worksheet or

.PIC file. Pixie offers the usual graph types (bar, stacked bar, line, bar/line, pie, word, bullet, and table) in three orientations: vertical, horizontal, and elongated horizontal for slides. The familiar Windows toolbox lets you annotate any graph with boxes. arrows, text, and so on, and you can import clip art (some is pro-

vided, more is available). There's a 98-color palette (fine-tunable to 16 million colors), plus five preset complementary color schemes: standard, spring, summer, autumn, and winter. You can specify a graduated tone background. Graduated tones look blotchy on-screen, great in a slide.

Since Windows isn't strong on direct support for film recorders (slide makers), Pixie allows you to save your file in the SCODL format used by Matrix

The Pixie manual is first-rate if your taste runs to informal, chatty manuals. It's supplemented by context-sensitive on-

Zenographics wants to put Pixie on end users' desks as a gateway into its powerful, highend Mirage/Autumn graphics package (\$1,195), which is popular with slide services and big corporate art departments. In Zenographics' world view. the Pixie/Autumn/Mirage combo leaves scant maneuvering toxas for in-between programs



Pixie Zenographics Inc. 19752 MacArthur Blvd.

Irvine, CA 92715-9976 (714) 851-6352 List Price: \$195. Extra type faces (Roman polygonal, Swiss bit map, Swiss reverse), \$95 to \$295. Extra clip art symbols,

Requires: 512K RAM; Microsoft Windows, Version 2.0; graphics card. Mouse and 286/386 PC strongly recom-

In Short: Cheap, nearly idiotproof Windows-based busin graphics with some drawing capabilities. Not copy protected. CIRCLE 489 ON READER SERVICE CARD

tus's Freelance Plus-an interesting, if somewhat dubious,

Pixie does support workgroup-oriented transfers among products using the emerging computer graphics metafile (.CGM) standard. Harvard. Freelance, 1-2-3 3.0, and PageMaker 3.0 support or will support CGM, and several word processors will shortly. (Lotus's Manuscript does now.) Most slide services accept CGM

Desktop publishers can switch to a black-and-white image without resetting each color, then clip the graph into PageMaker via the Windows clipboard or through CGM. Drawbacks? The first re-

lease version of Pixie suffered from a handful of bugs and quirks more annoying than fatal. Most are fixed now. Because it's a Windows product. Pixie shouldn't be attempted on anything less than a quick AT. and you'll need a mouse. You'll wish Pixie offered horizontal bar charts and a sequencing

mode for on-screen slide shows. Mostly, you'll be impressed by how much Pixie lets you do in a single room. Pixie worries moout me form, leaving you live to concentrate on content.

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ARCHIVE OF THE STREET

Tapestry II Networking Software Supports NetBIOS, SMB. 05/2

Torus Systems has launched Tapestry II, networking software for large single- or multiple-site LANs.

Primary features in Tapestry II are "Domain Management," which allow for management of local or remote logical groups of PCs and an icon-based user interfore

Tapestry II provides electronic mail, printer sharing, file management, a telephone directory, and security. There is also a time management system that allows you to schedule meetings based on individual users schedules.

Domain parameters and access privileges can be managed

from any PC in the network. The software will conform to industry-standard NetBIOS and SMB (Server Message

Block) protocols. It will support OS/2 running on both servers and workstations and both DOS and OS/2 on the same network. Microsoft has agreed to let Torus use LAN Manager technology for OS/2 nodes.

Tapestry II supports internetworking through an X.25 bridge or digital leased lines. Remote access is possible: the network PC does the processing, sending only screen information over the telephone lines. List Price: Tapestry II. Domain Manager Pack, \$695; single-station

extension, \$395; five stations. \$1.750:20 stotions, \$5.995:50 stations, \$12,500. Requires; 512K. RAM (640K for servers), hard disk drive for servers. NetBIOS LAN hardware, DOS 3.3 or later. Not copy protected. Torus Systems

Inc., 240 'B' Twin Dolphin Dr., Redwood City, CA 94065: (415) 594-9336, (212) 391-4499.

CIRCLE 441 ON READER SERVICE CARD

Video Seven Introduces Video Random Access Memory in V-RAM VGA Adapter

In order to make a VGA adapter | fers resolutions from 640 by 400 that runs faster than IBM's own. Video Seven, of Fremont, California, replaced DRAM-designed as system memory-with VRAM, which was designed specifically as video memory. The board runs with zero wait states and can shoot

out dots at a 65-MHz clock rate. Video Seven says the \$799 V-RAM VGA is compatible with IBM's VGA adapter for the AT. Video Seven has incorporated the undocumented high-handwidth mono mode and two undocumented registers used in IBM adapters. It ofto 1.028 by 768, with 4 to 256 colors depending on the amount of VRAM you install. Video Seven has added

FastWrite, a caching mechanism, and drivers for Microsoft Windows, Windows/386, Auto-CAD, and AutoShade to V-RAM VGA List Price: V-RAM VGA, \$799.

Requires: IBM PC AT or compatible. Video Seven Inc. 46335 Landing Pkwy., Fremont. CA 94538: (415) 656-7800. IDCLE AND ON BEADER SERVICE CA



Video Seven's V-RAM VGA adapter card uses custom VRAM instead of DRAM to provide faster video performance than IBM's VGA adapter.

80286 Machines Get a Speed Boost to 20 MHz with PCs from Astrid and Vector

Two new 80286-based PCs | sport 16-bit processors from Harris Corp. that run at 20-MHz

clock speeds. Vector claims its Excalibur 286 system outperforms 20-MHz 386 systems because of the 386's access checking overhead. The Vector Excalibur is further optimized by use of paged-mode memory interleaving, and by copying ROM and

video BIOS into RAM. Astrid Computers is unveiling the Astrid 286/20, which will be available in vertical floor-standing and desktop models.

Both the Excalibur and Astrid units feature hard disk controllers with 1-to-1 interleaving. The new machines from Astrid and Vector come standard with 512K RAM expandable to 4MB on the motherboard. The systems both support LIM 4.0 expanded memory.

The base configurations contain a 1.2MB 51/4-inch floppy disk drive, eight expansion slots (six 16-bit, two 8-bit), two serial ports, and one parallel

The Excalibur includes an EGA adapter, but no monitor, Astrid offers six configurations. from a model with no adapter to a VGA system.

Vector is selling 20-, 40-, and 65MB hard disk configurations, while Astrid has 70MB half-height and 150- and 320MB full-height options. List Price: Vector Excalibur 286, basic system, \$1,495, Vector Computer Corp., 7 Vernon St., Norwood, MA (12062; (617) 769-

CIRCLE 439 ON READER SERVICE CARD List Price: Astrid 286/20, from \$1,595 for basic system to \$6,195 for 19-inch color EGA system. Astrid Computers, 372 Turquoise St., Milpitas, CA 95035; (800) 328-8286, (408) 942-0696.

CIRCLE 440 ON READER SERVICE CARD

Miniscribe Half-Height 22-ms. Hard Disk Drive Stores Over 70MB

Miniscribe Corp. of Longmont, Colo, has announced a half-height 51/4-inch hard disk

The Miniscribe 71.3MB of formorred moss storage and an average access time of 22 mills



5318.

drive that supplies 71.3MB of formatted mass storage, with an average access time of 22 milliseconds.

The 3.2-pound Miniscribe Model 3085 features a rotary voice coil with closed loop servo positioning and contains four disks with seven read/write heads. It is rated for 35,000 hours of service. Its average power use measures 13.5 watts, and noise level is 40 decibels.

List Price: Miniscribe Model 3085, call company. Requires: ST-412 interface, one half-beight drive hay. Miniscribe Corp., 1861 Lefthand Circle, Longmont, CO 80501-6798: (303) 651-6000

CIRCLE 442 ON READER SERVICE CARD

NEW ON THE MARKET

RamQuest Extra: First RAM Board for PS/2 Models 50, 60, and 80

Orchid Technology's Ram-Quest Extra is the first memory board that provides up to 8MB RAM on IBM PS/2 Models 50, 60 and 80. The board also furnishes two serial ports.

Orchid says that RamQuest Extra and another new board,

the RamQuest II, which provides up to 2MB for Models 50 and 60 only, are guaranteed to support LIM expanded memory and OS/2. Full OS/2 support is possible because of Ram-Quest's use of IBM's TRAM

specification, and because Orchid doesn't alter the IBM reference disk during installation.

The hoards' installation software requires only four keystrokes

Orchid's \$599-to-\$1,199 RamOvest Extra is the first memo sion board for PS/2 Models 50, 60, and 80.

List Price: RamQuest Extra. with 1MB, \$1,199: with \$12K, \$899: with no memory installed, \$599; RamQuest II, with IMB. \$849. Requires: RamQuest Extra: IBM PS/2 Model 50, 60, or 80. RamQuest II: IBM PS/2 Model 50

or 60. Orchid Technology, 45365 Northport Loop West, Fremont, CA 94538; (415) 683-0300, (800) 654-3014

CIRCLE 444 ON READER SERVICE CARD

Compatible: the 20-MHz 5000 MC processor is included.

Tandy Corp., has fired its one-anticipated first shot in the Micro Channel clone wars. The Tandy 5000 MC not only emulates the IBM Micro Channel architecture, but also stakes out Tandy's position in the market for ultra-high-performance

80386 micros. The \$4 999 deskton machine runs at 20 MHz and uses Intel's 80385 cache memory controller. The cache is 32K of static RAM and effectively gives the system zero-wait-state operation, Tandy says,

The Tandy 5000 MC supports up to 16MB RAM: 2MB RAM is standard on the motherboard, and two proprietary memory expansion slots accommodate additional memory. A socket for an 80387 numeric coHard disk controller options

Tandy Unveils Micro Channel

include ST-506, ESDI, and SCSI boards. The ST-506 features full-track buffering, a read-ahead cache, one-to-one interleave, and a data burst transfer rate of 4MB per second.

VGA graphics are built into the motherboard. According to Tandy, one of the MCA-compatible expansion slots has the

video extension features to support future VGA enhancements. The Tandy 5000 MC is

available with an 84MB drive with 15 millisecond access time (\$6,999) or a 40MB, 18-ms. drive system (\$6,499), A 31/2inch floppy disk drive is standard, and there is room for three additional half-height drives.

The 5000 MC has five Micro Channel-compatible expansion slots in addition to the two proprietary memory slots. A 101key keyboard, key lock, and serial, parallel, and mouse ports are also provided. List Price: Tandy 5000 MC,

\$4,999; with 40MB hard disk drive. \$6,499; with 84MB hard disk drive. \$6,999. Tandy Corp., 1700 One Tandy Center, Fort Worth, TX 76102; (817) 390-2197.

DROLE 437 ON READER SERVICE CARD Tondy's 5000 MC does what an IBM PS/2 Model 80

does: it runs at 20 MH; and uses o Micro Chonnel-workalike bus.

PDA from Microspeed Turns a Serial Device Into Its Rus Version

PDA (Pointing Device Adapter) is the first add-in card that converts serial pointing devices like mice. trackballs, and tablets into bus versions, according to its maker, Microspeed.

The \$69, one-third-size adapter board gives bus I/O to Logitech, Microsoft, and Mouse Systems mice. Summagraphics and CalComp support is on the way.

Microspeed includes its MAP driver for ballistic gain control, a Windows driver, an AutoCAD driver, and keyboard



rial input device to its but equivalent, Microspeed includes drivers for Windows applications and AutoCAD.

TRAM sechnology means it will boot OS/2. emulation software. The driver supports VGA and earlier graphics modes. List Price: Microspeed PDA, \$69.

Requires: Serial pointing device, one-third-length adapter slot. Microspeed Inc., 5307 Randall Pl Fremont, CA 94538; (800) 232-7888

CIRCLE 443 ON READER SERVICE CARD

Citizen America Puts Controllers on System Board in AT Machine

Citizen America Corp .- a subsidiary of the watch company-has been known for printers, LCDs, and disk drives. Its first complete system is a 12.5-MHz AT compatible

called the Citizen Mate/12 The Citizen Mate/12 comes with IMB RAM on the motherboard, upgradable to 4MB of EMS-compatible memory.

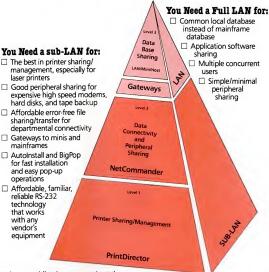
Each configuration includes a 1.2MB floppy disk drive, four expansion slots, two serial ports, one parallel port, and one mouse port. Circuitry for these interfaces, a flonny/hard disk controller, and the optional video interfaces are on the motherboard

The machines take up 17.1 by 16.5 inches of desk area and come with the latest versions of DOS and GW-BASIC List Price: Citizen Mate/12, basic

version, \$2,149; Basic Plus (with video interface). \$2,299; Deluxe (with video interface and 40MR hard disk), \$3,279. Citizen America Corp., 2425 Colorado Ave., #300, Santa Monica, CA 90404; (213) 453-0614.

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Time Line 3.0 Adds Outliner, Cost Tracking



BY NEIL J. RUBENKING

Time Line, Version 3.0, from Symantec Corp., is easier than ever to learn and use, and it offers enhanced performance and new features. The improved tutorial, context-sensitive help. and new outline-based scheduling style will get a tyro started in project management. Those who already know the subject will appreciate the improved Network View (PERT chart). effort-driven scheduling, cost tracking, and other new features. You do pay for the enhancements-Version 3.0 requires 640K RAM, while the previous version needed only 256K.

As with the previous version, the Gantt chart is the main view of a Time Line schedule. With 3.0, the Gantt chart includes an outliner. Tasks in higher outline levels automatically become summaries for their subtasks. Can't see all your tasks on the screen? Close up the outline and look only at summaries. The Gantt view is customizable, too. It will display your choice of up to 16 options from a set of 60 in the sequence that you choose. Or you can select a predefined layout, such as the "Brainstorm" layout that shows only the task



Time Line 3.0's new features include an outline-based scheduling stale, effort-driven scheduling, and several types of cost tracking.

names and notes

Effort-driven scheduling is a handy new feature. Now, rather than saving a task takes 2 weeks, you can say it takes 80 man-hours.

As you assign resources, Time Line adjusts the duration. If you're running behind schedule, you can see immediately what would happen if you assigned two more people to the task

Time Line's Network View (PERT chart) has been its weak. ness. It was inflexible and difficult to read. In 3.0. the improved Network View reflects the outline structure. Summary tasks appear as boxes around their subtasks. You can now open and close outline levels, edit tasks directly from the Network View, and change the display layout. Of course, the nested boxes take more space on the screen. You may choose to alternate between two layouts, one giving a wide view of the whole project, the other a de-

tailed look at one section With Version 3.0, you can now track actual expenditures of work and costs, along with the work achieved. To compare the real situation with the original plan, display the current schedule along with a baseline

The 640K RAM requireavailable ment means you probably won't have space for your favorite RAM-resident notepad, but

don't worry. Time Line provides that facility itself. Every note field can hold up to five screens of text, and the notepad can read and write external files. There's also a Journal for the entire schedule, automatically kept in outline form.

In our last analysis of project managers, we made Time Line an Editor's Choice. Its combination of power and ease of use won it that title. Version 3.0 is better in every way.



Time Line, Version 3.0 Symantec Corp. 10201 Torre Ave Cupertino, CA 95014 (40K) 253-9600 List Price: \$595; upgrade price from Version 2.0 is \$99 until May 31, \$195 after

Requires: 640K RAM, hard disk with 2MB free; IBM PC. XT, AT, or PS/2; DOS 2.0 or later, Will use EMS/EEMS if available. Not conv protected In Short: An impressive upgrade of what was already the best low-end project manager

DIRCLE 446 ON READER SERVICE CARD

Dac-Easy Light: Accounting Without Tears



HANDS ON

BY JONATHAN MATZKIN Dac-Easy is a well-known, popular accounting package, but I doubted that the "lite" version could be of use to someone as squeamish about keeping track as I am.

I was wrong. Dac-Easy Light, from Dac Software, is an extremely easy-to-use accounting system for personal and small-business use. Light's menu-driven operation shields you from the mechanics of ac-

counting while maintaining ! necessary records. You can track multiple bank accounts. credit eards, and invoices without ever looking at an accounting form.

When installing the package, you specify whether your records are for home or business accounting, and Light generates the necessary files. These files differ slightly, but the user's interaction with the software changes little

From then on, everything proceeds more simply than any Accounting 1A student could

ever imagine. If, for instance, you want to enter a check, the program pops up an image of a check, and you fill in the blanks. Light's main menu has an

option laheled "accountine" for those who care to rush in where nonaccountants fear to tread. You can see the general ledger transactions that the program maintains, make debit and credit entries, and edit your Chart of Accounty

Duc sells a complete line of checks, invoices, and other forms to be used with Dac-Easy Light and your printer.



Dac-Easy Light Duc Software Inc. 4801 Spring Valley Rd. Blde, 110B (214) 458-0038 List Price: \$69.95

Requires: 256K RAM, one floppy disk drive, DOS 2.0 or In Short An accounting package for nonaccountages. Not copy protected.

ORCI F 440 ON READER SERVICE CARE

"Within a few days, SideKick *Plus* became even more indispensable than SideKick" Dick Pountain, Personal Computer World

Here's what Personal Computer World had to say about SideKick® Plus

"When the news of SideKick Plus arrived. I made up a shopping list of the improvements I would like to see ... Borland has provided all these things and much, much more." Intelligence and elegance of design

"I discovered that the same intelligence and elegance of design that initially attracted me are still there, and certain new features like the customizable menu system represent a real breakthrough in user interface design."

Sophisticated memory management

Memory management in SideKick Plus is so sonhisticated that it almost amounts to an alternative operating system ... The amount of memory tied up is tiny (less in fact than old SideKick!) ...

The Phonebook: Fully-featured communications

"The Phonebook has come a long way ... For one thing, it has acquired a fully featured communications package which can work in the background; you can upload and download files while continuing to work on your PC ... The Script language is one of the best I have seen

The Notepad: Power for serious writing

"The Notepad is as powerful as many word processors . . . I would happily use it for serious writing." "Up to nine notepads can be opened simultaneously with SideKick Plus.

Outlook: The best outline processor "Outlook is ... the best outline pro-

cessor I've tried, comfortably beating ThinkTank, PC-Outline, and Ready! In elegance and ease of use."

31/2" and 51/4" disks included. Hard disk required.

Number statistics a or tax caters, if talks to lay of pertur its protest inn or days with not claim, call not capage arrest displaces, and we set proper actions.



The File Manager. Competing with the standalones

'The File Manager . . . performs a similar function to standalone utilities like Xtree, Quick DOS, or the Norton Commander. and shares features with all of them.

The Time Planner: Hugely enhanced "The Time Planner has advanced even further

than the Phonebook . . . It has been designed with networking in mind."

Plus a lot more

"The enhanced cut-and-paste functions are perhaps the most attractive feature of SideKick Pius ... lit! has a powerful, consistent ability to cut-and-paste from any application to any other." The calculator is no longer one, but four calculators:

you can switch the type to Business, Scientific. Programmer, or Formula."

Positively addicting!

"In my view, the individual applications in SideKick Plus are of such a standard that I would be hard put to better them with a collection of standalone applications ... I remain an addict.

> Excerpts from Dick Pountain's review of SideKick Plus in Personal Computer World, March 1988

If you have the Intel® Above Board you can load the SideKick Plus desk accessories into expanded or extended memory and leave most of your conventional memory to run your other applications.

Ask your dealer about Borland's special off for SideKick owners



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CIRCLE 197 ON READER SERVICE CARD

DesignCAD 3-D Offers True 3-D Drafting and Shading for \$300

PE HANDS ON

BY MITT JONES

DesignCAD 3-D, the latest feature-packed, low-cost CADD
package from American Small
Business Computers, delivers
more bang per buck than any of
its low-cost competitors and
threatens programs costing ten
times as much

sional sibling. DesignCAD 2-D.
A multilevel menu traits down
he right edge of the screen and a
command line rests at the bottom. The similarities will be
comforting for AutoCAD and
DesignCAD 2-D users alike.

DesignCAD 2-D users alike.

As anybody who has used a

3-D package can attest, however, simulating three dimensions on a two-dimensional screen tends to be anything but com-



DesignCAD 3-D normally displays wire-frame images but also provides a shading committed. The three windows to the left display wire-frame views of the same object.

For \$299.95, DesignCAD gives you true 3-D drawing and powerful features like layered drawings, shading, dimensioning, and all the plotter and print-

er support you could want. If you're looking for the features you'll need to do serious drafting work, however, you may be somewhat disappointed. Until the next release, Design-CAD 3-D lacks a filler function, parallel line commands, varied line thicknesses, and traditional fill patterns—features some professionals will refuse to live without.

In the meantime, Design-CAD presents itself as an excellent tool for visualization and for creating high-quality 3-D output—the traditional role of 3-D packages for the PC.

DesignCAD 3-D builds on the same AutoCAD-like interface and feel of its two-dimenforting. Using a typical isometric view—you'll want to view your creation with a 3-D perspective as you draw it—the cursor never seems to be quite where you think it is.

DesignCAD 3-D handles the problem by stacking miniature front, top, and side views to the left of the larger, primary view. The secondary views include surprising detail and do an excellent job of pinpointing the cursor position without hogging

DesignCAD gives you sereral ways to create three-dimensional objects. You can create two-dimensional entities—or predefined forms—in any plane and project them outward, or you can choose one of a handful of three-dimensional entities. In addition to a nice assortment of 2-D entities—including ares, arrows. circles, curves, lines, arrows.

rectangles, polygons, and polylines—you'll find commands to create boxes, cones, cylinders,

hemispheres, and spheres. For those shapes that don't come in a can, you've got a selection of commands to create your own. For example, the well-thought-out uttorial walks you through creation of a gobbet by connecting line segments in one plane, defining the shape as a block, and then sweeping the shape through 360 degrees. You could then define the finished gobbet as a block and copy it to a file, change its color, rotate it,

The program draws even its canned entities as wire-frame objects, so screen redraws take relatively little time. Still, you'll want to use a math oup coprocessor to speed redraws; the Shade command, which gives the drawing a modeled appearance and proves absolutely irresistible to use, can keep your system busy for minutes.

DezigicÄAD's layering abiliyi so neo fix most powerful features. You can create drawings with as many as 21 separate layers. This allows a floor plan to be created with different levels devoted to different aspects of the building design. Each layer can be displayed, plotted, or exported individually or along with other layers. An option you set determines whether certain editing commands affoct objects in all active layers or

only the current layer.

Other notable features include macro capability, bill of materials generation, 15 fonts of sizable text, six styles of dimensioning, with leader lines; point specification in absolute or relative nectangular coordinates; a snap grid, though no grid appears on the screen; and various snap commands to help position the curror at precise locations on either objects or planes.

DesignCAD 3-D supports about 80 plotters and 200 printers. Import/export capability in-

cludes conversions to and from HPGL, IGES, and AutoCAD .DXF formats. You can also translate to GEM and PostScript file formats

file formats.

Design(AD is somewhat
difficult to learn, though no
more so than AutoCAD. That's
partially because its drawing
flexibility forces you to think in
three-dimensional terms, but
also because the documentation
tends to skimp on explanation.
The rather areane command abbreviations are also difficult to
remember, an annoyance that
tends to keep the reference manual in worr lan.

AutoCAD remains the de facto CADD standard of the PC industry and, especially considering its programming language, offers more features and far more flexibility for general use than DesignCAD can currently claim.

For a low-cost, self-contained 3-D package, however, DesignCAD's range of features steals the show. The package offers more-than-adequate features for a wide range of professionals and hobbyists alike. The next release, slated for late summer, will add mass and volume calculations, fillet and parallel line commands, and a BASIClike programming language. 28



DesignCAD 3-D American Small Business Computers Inc. 327 S. Mill St. Pryor, OK 74361 (918) 825-4844

List Price: \$299.95
Requires: \$12K RAM (640K recommended—also supports expanded memory), two disk drives (hard disk recommended), graphics display, DOS 2.0 or later. \$087/\$0287 math co-

processor recommended.

In Short: A full-featured 3-D drawing package that competes seriously with programs three times its price. Not copy protected.

CIRCLE 406 ON READER SERVICE CARD

"Behind the beauty of the Turbo C environment stands the brawn of a full-fledged compiler"

Marty Franz, PC Tech Journal

44 Taking compilers and program development tools into the next generation is Borland International's Turbo C, a \$99.95 package that will sun you with in-RAM compilations that operate at warp speed.

... a 21st century compiler at a preinflation 1967 price. Is it any wonder that Turbo C was included in the Best of 1987?

Richard Hale Shaw, PC Magazine Turbo C represents an all-new

price-performance level—one that will be hard to match, much less beat. Stephen Randy Davis, PC Magazine

Stephen Randy Davis, PC Magazine

Turbo C showed excellent compiler speeds, good overall benchmark scores, and extraordinary floating-point performance. Scott Robert Ladd, Micro Cornucopia ??

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libraries

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language and the library routines

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including windows

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 VGA, CGA, EGA, Hercules, and IBM 8514 support

· File search utility (GREP)

Sample graphics applications
 More than 100 new functions

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Professional Write Offers More File Formats and Font Support Professional Write, Version 2.0, from Software Publishing Corp., reads and writes files in several word processor formats, including WordPerfect and Microsoft Word, Version 2.0



With Version 2.0 of Professional Witte, users can convert file formats by simply string a file to one of the formats that the word processor application supports.

also supports a variety of fonts. The fonts are preset, so no user installation is required. Enhanced table editing and direct 1-2-3 worksheet importation are also new to Version 2.0. Software Publishing Corp., Mountain View, Calif.: (415) 962-8910.

Time Line 3.0 Adds PERT Chart and Extensive Outlinion

Symantec Corp. has reclesigned Time Line around an advanced outlining feature. Version 3.0 of the project manager also offers a new PERT chart view of task dependencies. Time Line exploits EMS memory and manages up to 1,600 tasks. The package sells for \$595. Registered users of Version 2.0, which remains available, can upgrade for \$195. Symantec Corp. Cuperino, Calif.; (145) 964–4440.

MemoryMate Supports Multiple Databases, Numericari MemoryMate, the S69 free-form information manager from Broderbund Software, now supports multiple databases and creates hypertext links among database records. The maximum record size has been doubtled to 200 lines and data file size is limited only by disk size. EMS memory support allows MemoryMate to fit into 30K of DOS RAM. Broderbund Software Inc., San Rafael, Calif.: (415/149-2300)

Finite Element Package Supports Weitek Math Chia Structural Research and Analysis Corp. (SRAC), says its finite element analysis packing acc. Commod/M. has been upgraded to support the Weitek. 1167 math coprocessor and has been rechristened Commod/M. 366. Engineers. 1803/80 PC, to solve structural problems of nater and the control of the Commod/M. 366. Engineers. SRAC. SRAC, Santa Monica, Calif.; (213) SRAC. SRAC, Santa Monica, Calif.; (213) GEM Desktop Publisher Costs Less, Has More Features GEM Desktop Publisher. Version 1.1, is available for a list price of \$599, 25 percents bow the pervious list of \$599. The pexchage includes GEM/3, a graphical front end of ro Dod. Belleview from the former gentity for customizing foot stees. Belleview from the former of GEM/3 by the dadition of GEM/3 by the dast graphics and text to flavor on VCM perial Publishers was feet with the volume of GEM/3 by the dast graphics and text to flavor on VCM perial Publishers before Manch 31, 1948, will receive a free upgrade. Digital Research, Montercy, Calif. (1968) 693-396.

MicroPro Upgrades WordStar Professional, Ports 2000 to 05/2 MicroPro International Corp. has announced a major appraise of WordStar Professional and an OS2 version of WordStar 2009. WordStar 700 WordStar 700

NEC Drops Price for Hayes-Compatible 9,600-bps

NEC has lowered the price of its DSP 9630 modem from \$2,495 to \$1,895 for the external model and from \$2,395 to \$1,795 for the inter-



NEC's DSP 9630 modern offers V-32 companishing, 9,600bps transmission, and a newly reduced price (\$1,895).

nal version. The modern is fully compatible with the CCITT V.32 standard and supports the Hayes AT command set. NEC America Inc., Melville, N.Y.: (516) 753-7000.

IN BRIEF

Saba Technologies says that Version 2.0 of its 51.299 Page Reader, an optical character recognition device, reads doft matrix forts and inparts data 25 percent faster than entire evenions. Society of the control of the control



Here's a radical idea: give people who work together the means to easily share information among PCs—but don't force them to become computer experts to do it.

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As if all that weren't enough, TOPS runs over common twisted-pair cabling, such as regular phone wire. And at only \$189 for the software, and \$239 for each TOPS FlashCard, TOPS is the least expensive way to get your workgroup working together.

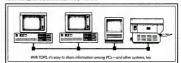
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Amazing Facts I

"The enhanced compiler answers a series of product introductions over the past 3 years by independent software developers that speed the compilation of dBase-built programmers." -Electronic News, Febru-

ary 22, 1988

Amazing Facts II

"More than 10 companies make laptops today . . . The newer models have more built-in programs and larger memories than earlier versions, and the capability to run IBM software, a big plus because IBM puts out a glut of programs."

-Detroit Free Press, March 3. 1988

Amazing Facts III

"A multiuser bulletin board that supports an unlimited number of users was announced recently by Surf Computer Services. The Oracomm bulletin board comes in versions that support up to three or up to 10 users simultaneously .

-InfoWorld, February 22. 1988

Amazing Facts IV

"The hardware compopent . . . is a 16-bit IBM AT compatible board that captures images from RGB (red, green, blue) or National Television Standards Committee (NTSC) sources such as video cameras or hand disks."

-PC Week. February 9.

Amazing Facts V

"[With our C libraries] your application code can be up to 100% smaller.

-Ad far Entelekan C libraries, Houston, Tex., in Borland International's Turbo Technix magazine

Amazing Facts VI

"ROM (Random onboard memory) can be compared to reflex response in a human being. It operates automatically, regardless of any outside instructions to the computer. It instructs the computer what to do when it is turned on or off."

-The Knoxville (Tenn.) News-Sentinel, February 15, 1988



Horepropertial is GEM 1st Word Play." It provides displays like this even with the power south him the off position



ment that pages he fed image-side down.

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Kithmetic module not its linded, indeer ttsement in the February 15, 1988, tasse of DP Sheet, a Houston data processing publication

So Fine

"Subing said he found MCAF software attractive because it offers fine element analysis." -Computer Reseller News, November 30, 1987

Techno-Speak

'I have read through your program listing and associated output and I see the 4.603 calls to INT21H Service 81 that you mentioned. I can't comment on this fact to you because of the proprietary nature of our software and the 'undocumentedness' of undocumented MS-DOS function calls.

Letter from Microsoft Technicol Support stuff to Microsoft CodeView user

Send entries to Communiques, PC Magazine, One Park Avenue, New York, NY 10016 Include your name, address, and T-shirt size; nablication name, date, and incurion, Winners receive \$50 and a PC Magazine T-shirt

Wonners this issue C Williams (Princeton scanner), Gene Bustwick (5 R's), Roger Turner (GEM 1st Word Plus). Michael Barke (dBase programmers). Garcin Greene Haptops), H. Robert Bands (unlamited 10-user bulletin board), Gary Huey (NTSC hard disks), Kenneth Athon transfort imbourd memory), Dun Rubis (fine element analvsts J. Ken Johnson C'andox amentedness'').

INTRODUCING TIME LINE 3.0: BECAUSE THERE'S NO SUCH THING AS TOO MUCH POWER.



NOW THE #1 PROJECT MANAGER* PUTS EVEN MORE POWER AT YOUR FINGERTIPS.

Hold on to your personal computer. Hold on tight. Because without sacrificing Time Line's almost legendary

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 need to see. Toggle between two PERT layouts to see the oversill project or zoom in on specifics.
 Customizable Gantt with user-definable screen layouts. Add columns to show
- dates, resources, durations, costs, etc. Overlay Gantt with histograms for up to
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 **Undo or Redo up to 999 steps foe "what if" scenario analysis.

 **Multi-Project Management with no linking required. Outline organizes multiple projects in a single schedule.

 **Project Journal acts as outline based scenatch pad and Notes attaches reminders.
- Baseline tracking produces Actual vs. Plan Gantt. Cost tracking records "actuals"
- awa present competer.

 Supports perennent reporting requirements (C/SSR). Calculates earned value and supports WIS and OBS numbers.

 Virtual Memory supports 1000 tasks with 640K RAM (1600 tasks with EMS extended memory).

 Customizable report generator is form driven to make it even easier.

ease of use, Time Line 3.0 just raised the standard of micro-based project management. By macro proportions. Imagine. An advanced outline structure from the company that invented outlining. + Interactive on-screen PERT. Multi-project scheduling and resource allocation without manual linking. And a customizable environment including Gantt, PERT, and reports. All this plus plenty of power features like the ones in the box. Seamlessly integrated. Easy, And only \$595.

Hundreds of enhancements, easy to navigate outlining... technology so advanced there are patents pending. Call (800) 888-0886 Ext. 190P for a FREE demo disk (a \$9.95 value) or FREE corporate evaluation. Time Line 3.0: the power will blow you away.

The #1 Project Manager



SYMANTEC *Time Line 2.0. PC Magazine Editor) Chara 1986 d. 1987, said #1 by Software Enged Post Time Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or PC with Breith Copy Software Line 2.0.486 in the best character for laptopia or laptop CIRCLE 209 ON READER SERVICE CARD





Perfect matches to DEC user needs. Hip. Hip. And Hooray.

One-size-fits-all is an attribute best reserved for inexpensive socks. In the realm of PC-based emulation and communications software for DEC mainframe users, it's important to match specific user needs with specific product attributes. We have.

Smarlerm* 240 features exact four-color emulation of a DEC* VT241 terminal. Along with delivering full-screen ReGIS* and Tektronix* 4010/4014 graphics. Smarlerm 240 offers precise VT220, VT102, VT100, and VT52 text emulation.

For non-graphics applications, Smafferm* 220 duplicates virtually every Smafferm 240 text, communication, and ease-of-use feature. Three error-free file transfer protocols, including Kermit and Xmodem, are provided. Downloading minimizes on-line time requirements to boost overall system efficiency. And an optional network package allows direct LAN access to shared modems, printers, as well as host mainframes.

As Smarflerm 240 and 220 focus on graphics and text, new SmartMOVE* makes PC-to-the-rest-of-the-World communications sharper than ever Speed connect, auto redial, and background file transfer features make this VTI00 emulator a loud and clear choice for advanced communications requirements.

Graphics, text, and communications. If you're looking for a perfect fit, seek the software sized and priced to match your needs. Persoft has it. Period.



WHEN WORLDS COLLIDE



The coming conflict between PCs and workstations has been described as a collision. Rather than that apocalyptic vision, it may more likely resemble "Invasion of the Body Snatchers."

George and Martha are driving down the DOS Highway in their PC Behemoth. Suddenly there's a thump from beneath the wheels.

"George, did we hit something?"

"Relax, Martha. It was probably just an

armadillo."

If, in fact, the DOS and workstation worlds were on a collision course, that's about the size of the effect the 300,000 workstations would have on the 14 million PCs. The collision analogy, however, is a poor one.

The real nature of the intersection of these worlds will be more like a viral invasion, except that we have nothing to fear from the attack. Like the pod people in Invasion of the Body Statchers, our computers will be the same, only different. Just as vinces use a genetic template to subvert a cell's processes to its own purposes, workstations are the genetic template for future PCs. We should all prepare to be willing victims.

IBM is one of the chief architects in the process of unting the PC into a workstation. Entry systems division president Bill be moving the cupit value of the moving the capital and the process of until the moving the capital and the process of a million pixels, the 834 is grophics for the motherboard and but the most exacting CAD applications. IBM aromoter, a usual conditions of the problem cashly remedied by IBM or in the aftermarket. Right now the 8514 adapter is a \$1,500 option. Next year it! In be standard. Don't be surprised if, along the way, it finds another 250,000 pixels to manage.

The million-pixel (or megapel) figure is a magical one in the workstation business and has long been an IBM dream for its personal computers.

THEY'RE TAKING OVER Lowe has also said that IBM's whole product line will eventually be 386-based. That's as it should be. The demands of application software and operating systems alike will be too great by then for the wheezing old 8088s to deal with. Some users regard this as a conspiracy. So it is, although no one is

forcing you to participate.

You'll wish you had, though. By then 286 will be suitable only for low-end applications. Everything with a future path will be based on the 386. The infection will have spread to the point where most business applications will multitask. OS/2 LAN Manager and distributed applications will be commonplace. The graphical user interface will be a rampant fever by then,



fueled by the success of the Macintosh in the workplace. Ignore it at your own peril.

The workstation market has rediscovered what printers and typographers and typographers and known for centuries: typefaces and styles can alleviate the otherwise unremign boredom of the printed page. Likewise, the graphical sust interface overcoming boredom of the printed page. Likewise, the graphical susts interface and the stufflying effects of the 25 by 80 screen langine if everything you read was printed in Courier. Or even in this 10-point Times Roman. That's what you subject voted to when you stare at your character-generated monochrome or color screen.

Workstations, by virtue of their graphical screens and multitasking, are more in sync with the now de facto output device, the laser printer. As soon as you have full control over typefaces and sizes, the character-based interface becomes obsolete. So does the 13-inch screen. Have you ever created what appeared to be a reasonablelooking document with Microsoft Word, WordPerfect, or some other program, only to find it criminally ugly when it emerged from your printer? You're not alone. Even the previsualization screens found in Manuscript and WordPerfect 5.0 (and available for Word) are no help. They're look-but-don't-touch fun-house mirrors that give you a distorted, although recognizable, view of your document. Workstation users don't have these problems. Never did. The bitmapped display has always given an accurate depiction of the printed output.

Workstations have led the way in processing power, too. Today's mainstream workstations are three to five times as

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powerful as your run-of-the-mill PC AT or PS/2 Model 60. So are 20-MHz 386 machines. The advent of these machines and their virtually unlimited memory canabilities has induced software designers to write software that would never have appeared on even a 286. For instance, Interleaf has long been a premier technical document publishing system. It had been available only on workstations until they ported it to the PS/2 Model 80. Now IBM has agreed to market Interleaf as its highend desktop publishing product, something it couldn't consider until the Model 80-111 was available.

ness of the 80386 chip is coming as something of a surprise, especially to the Motorola devotees, who were counting on the Macintosh II and several other 68020based workstations to seal Intel's fate. Intel, riding on the strength of the installed base and its powerful allies, Microsoft and IBM, has cut some interesting deals lately. Outstanding among them is the Sun Microsystems 386 machine. Someday people will call this machine "the lungfish," for it's the one that will ultimately marry the existing 386 software base and technology with Sun's powerful SPARC reduced-instruction-set chip. In one stride, PCs will have crawled out of the primordial ooze of mundane applications, and workstations will have joined the mainstream of DOSbased productivity.

It's premature to congratulate Sun for its accomplishments since the machine hasn't shipped yet. But it isn't too early to applaud its vision. As John C. Dvorak has pointed out, Sun has drawn back somewhat from its original vision of selling SPARC chips to all comers, thereby flooding the market with its remarkable little RISC engines. Instead, it will likely cut some careful licensing agreements, thus protecting product lines and price points as it picks up manufacturing partners. Now that AT&T has a 20 percent share of Sun. it's pretty obvious who gets the first crack at a mainstream DOS/RISC workstation Maybe this will be the magic eombination that finally puts AT&T into the running. So watch out for that next bout of the

flu. You could emerge with more computing power than you ever dreamed of.



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REPENT! THE END IS NEAR



The signs are everywhere: the era of declining hardware prices and plentiful supplies is drawing to a close, and a time of confusion is beginning.

crisis is at hand. You'd never know it, though, from the newspaper persports and the rosy prognostications of so-called experts. Simply put, the microcomputer industry is in for a series of shocking price hikes, shortages, vendor shutdowns, and spiraling confusion.

LOCAL HEROES? It all surned with the sudden increase in the price of menor, chips. The 256K chips jumped from a little more than a dollier each to as high as \$8 apiece. People with long-term contracts got the message was that their contracts were no good. They'd have to ppr more, too, Some analysis predicted that this would be a great thing for Ameriments. Morrorit, and even fined will get back into the memory chip business to save the day.

Then suddenly, as if they'd been boardde, some chips from American semiconductor firms appeared at the same prices as the Japanese chips. It turns out that the American firms don't want to get back in get in the board of the same prices as get in the same prices are proposed to get in the same prices are prices as the get in the same problem firms in Feast that pump oil only when prices are they. The most of these firms seems to be, "Why work?" So much for responsible capitalism.

AMERICANS IN A FIX While the American reentry into an inflationary market seems like a way to stabilize price increases, a study of the oil scene shows that a price neversal because of a free market doesn't take place when price-fixing exists. The Japanese can price-fix and who's to stop them? What's happening, of course, is what the most-pannoid experts said would happen: the Japanese would increase market share, take over a market them gouge the hapless buyer with fixed prices. The American firms now wait until they can jump in and take part in the feed-

This is made more obvious by Micron Technologies' under hike of its memory chip prices. Did the price of sand go shooting up in Boise, Idaho? Atari is now suite Micron for needing on its contract. Micron is the firm that got the boneheads in Washington to protect American memory manufacturers with congressional action. This is the final thanks we all get for this protectionist legislation. The irropy for the PC user; it that the abborrent memory re-

quirements for OS/2 only exacerbate the problem. Great.

Meanwhile, it turns out that the priceling on memory, chips is really just the tip of the iceberg. Most vendors who import components say that everything is going up in price—fast. If there is any doubt that the Japanese vendors sometimes work together as one big money-making corporation, look no further than the current price lists for disk drives, monitors, and keyboards. All the prices rose as much as 300 percent overnight.

The Koreans and Taiwanese are no fools, and they go right along with the Japanese agenda. According to traders, this happened so suddenly because the Asias were tired of supporting their old prices in an effort to keep the U.S. dollar buoyed. When the dam breaks, it breaks.

Our analysts tell us that this trend is somehow good: it means that America will benefit by making computers at home. With what? With American monitors? With American floppy disk drives? Come on. All the mass production for components is done overseas. Who are we kidding?

from all this is obvious. For the first time in the history of the computer industry we will watch the price-performance ratio reverse itself. We'll have to pay more money for less power. This will lead to the typical inflationary cycle of panic buying aggrawating the shortages and creating more opportunities for price-gouging. Welcome to the real world.

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INSIDE TRACK

Viruses afflict commercial software; panic spreads; new vaccines protect endangered disks.

The long history of destructive computer programs came to a head as a computer virus found its way onto commercial software. Untold copies of Aldus's Freehand were infected and had to

be recalled.

The notion of subversive software began back in the 1970s with a program that ran around the Defense Department's ARPANET messaging system. Dubbed the Creeper, it was one of the first "worm" programs. It consisted of some code that literally wormed its way around out the code that the code that

This seemingly silly idea soon evolved into the next type of subversive program, the Trojan Horse. When a program containing Trojan Horse code entered a system, the program would have a hidden agenda, such as waiting until a specific event or date, then executing code that, say, destroyed the contents of a hard disk.

The nature of these programs was popularized in a lohn Brunner novel called *Shockwave Rider* (1975), which is a cult classic for programmers. Soon thereafter a definitive paper was written and published by researchers at Xerox PARC.

lished by researchers at Xerox PAKC. The true virus program is the most advanced form of subversive code. Itsinvention is credited to Professor Fred Cohen of the University of Cincinnati, who, when a grad sudent at USC in 1983, first exhibited how a virus code would work and later discussed the concept during a famous speech be gave in Toronto at an IFIPS (International Federation of Information Processing Societies) security conference in 1984. The key to the virus is that it attaches itself to some software (such as the COMMAND.COM program on an MS-DOS machine), and its first duty is to replicate itself on other systems and spread. In Israel, where a couple of outbreaks occurred, these programs are called software AIDS—a reference to the acquired immune deficience sundrous.

ciency syndrome. A couple of years ago, when another outbreak of these things occurred, a funny thing happened to me. I was contacted by a writer at the National Enquirer who was looking for a quote about the potential horror of a worm or virus program getting into the big Defense Department computers and launching World War III. I concluded that if some nitwit who knew the ins and outs of the software wanted to do such a thing, it was indeed possible. As the Enquirer continued to plug away at the story, it got so out of control that they figured it would scare the beiiggers out of the old ladies who read the paper, and they dropped it like a hot potato. Flying saucers and Morgan Fairchild-approved diet tips were safer fodder for the editorial gristmill, it

seems. Meanwhile, excent panic over visus software has stirred developer interest. Here are some current "seactive" projects. One of the most interesting is from Sophore (Fr. D. Box 1930, Boulec, r. O. Box, 1930, P. D. Box, 1930, P. O. Box, 1930, P. O. Box, 1930, P. D. Box, 1930,

So Sophco developed three programs: SYRINGE.EXE, CANARY, and INFECT. SYRINGE is the vaccine program, CANARY is a program to quarantine a suspected disk, and INFECT is a benign virus program used to test the effectiveness of the other two programs. The company will sell the system for \$29.95 to anyone interested. It looks well worth the money.

In Canada, Orion Microsystems (P.O. Box 128, Pierrefonds, Quebec. Canada H9H 4KB; (514) 626-9234) created an excellent vaccine program called NTIVIRUS.EXE. A new version is being tested as this is written. Selling for \$29.95, it too is worth a look. The owner of the small firm, Madiid Bourki, tells me that last year a virus broke out on the IBM international e-mail system and copied itself onto every system it could infect. When activated, it drew a Christmas tree on the screen and prompted for a keyboard entry to clear it. IBM had to send out technicians to hand-clean the network and various infected systems. Madjid coined a new term for this

code: garbágeware.

RG Software Systems (2300 Computer Ave., #1-51, Willow Grove, PA 19090; (215) 659-5300) is actively adding antivirus code to the latest version of its 579-95 utility called Disk Watcher. Disk Watcher actively watches the disk drives to let the user know when they are getting full and to stop the user from accidentally formatting a hard disk.

All of the above vendors would like to see any virus code that you may have collected. Send copies to me too. Ceransky tells me that his firm disassembled a couple of newfound viruses and discovered the Redmond, Washington, ZIP code. "It wasn't a compiler message, either,"

Finally, there are a few public-domain vaccines floating around and available through your local user group. Ask the librarian for more information.

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SEMICONDUCTOR BLUES: TIME FOR COOPERATION



 $U.S.\ semiconductor\ companies\ lag\ behind\ in\ building\ chips.\ They're\ looking\ to\ the\ Sematech\ research\ facility\ to\ come\ up\ with\ ways\ to\ make\ cheaper\ and\ better\ chips.$

Just as economics is affected by those famous "exogenous" forces we hear about on high-brow television—external events seemingly apart from the matter at hand but in fact directly tied to it—the PC industry is powerfully impacted by forces moving through other businesses.

What's happened in the semiconductor business is a good example of those blindside impacts. But new ideas are afoot in the U.S. semiconductor industry today and may lead to the kind of changes needed to return that business to sanity.

Last time, I bemoaned the rise in RAMchip prices over the last several months. Those increases are making it too expensive to add the substantial doses of RAM we need to make the most of OS/2 and DOS extensions, such as Windows/386 and the LIM EMS 4.0.

Part of that steep increase in memory prices has to be laid at the feet of an unfortunate U.S.—Japan trade agreement made in 1986, which in the best protectionist style was supposed to help the fumbling U.S. semiconductor industry return to profitability.

Japanese vendors were shown to have been "dumping" their chips here—that is, selling them in the United States at lower prices than elsewhere—with a depressing effect on the prices, profitability, and maybe even survival chances of U.S. chipmakers.

So we made Japan Inc. promise to charge us more—lots more—for RAM chips than they had been charging. Beat me, whip me, charge me more, please, Mr. Japan. Oooh, I like it. ON THE DOMESTIC SCENE The larger issue is why the U.S. chip business is so consistently noncompetitive. Intel missed the importance of the ASIC marised the importance of the ASIC market; last year's fumbles in producing 3806 brought into question the company's ability to manage even successful products. National Serincienductor invents wonderful chips but no one uses. Advanced Miron Devices Securite dependent on the reroot Devices Securite dependent on the retroe the State of the Company of the the State of the Company of the the State of the Company of fundamental closes: and Intel's refusal to extend the deal to the 386.

The list goes on. Excepting Motorola's 68000 series and a few innovative moves by such smaller companies as Micron, LSI Logic, and Cypress, the U.S. semiconductor business shows little understanding of how and when to bring new technology to making chips.

At the same time, the U.S. semiconduc-



tor industry has given us such commercially successful chip designs as Intel's 8088 and 80286—and such technologically successful designs as the 80386, National Semi's 32032, and Motorola's 68020 and 030. How can this be?

The chip industry is divided into two very different businesses: designing chips and building them.

The U.S. remains way ahead in chip design. Mostoral's 68030, now sampling, and Intel's 80486, now in specs, provide ample evidence of that. IBM and AT&T have made fundamental improvements in high-density memory chips; the one-megabit chip and its successor gree directly from that work. And the specialty-chip houses, led by Chips and Technologies, routinely design chip sets functionally equivalent or superior to system designs from the likes of IBM.

But we do an absolutely awful job of making those chips.

An obvious answer is to design chips here but produce them "offshore." Many find that idea unacceptable both from a strategic-industries perspective and from a competitive stance: Ship your design off to a foundry in the Far East, the story goes, and by the time you get sample quantities back, your design will have been pirated all over Asia.

BETTER, CHEAPER CHIPS A better answer is to get our act together and learn how to build chips here as well and as cheaply as they're built abroad. The key is 'yield': the number of usable chips you get out of a silicon wafer. Yields are higher

■ JIM SEYMOUR

on many high-tech Asian production lines than at domestic plants; hence the Asians' costs and prices are lower. The track proord of U.S. chipmakers

The track record of U.S. chipmakers gives little hope that in their intensely com-

petitive universe, any of the major players will be able to fund the research necessary to leap a generation ahead in chip-building technology, then make the considerable technology on-line in their plants.

That's why Sematech is so important. A basic-research combine of U.S. semiconductor companies, Sematech was assembled to fund that kind of work. Set up in Austin, Texas, earlier this year and expected to be producing chips in its prototype foundry by the end of this year, Sematech includes all the major players in U.S.

chipdom.

Smaller players will undoubtedly come
in, too, as Sematech adjusts its membership fees. Today it costs \$1 million and up
to join, plus an additional and unnecessary
pledge of support for Semiconductor Research Corp., a North Carolina universityresearch effort.

Though IBM opted out of MCC, Amer-



ica's other high-tech research consortium, Big Blue has come into the Sematech fold—and, with AT&T, has made contributions of state-of-the-art technology.

GETTING THE EDGE Competition among companies and nations sometimes gets so brutal that market forces are overwhelmed and collective action becomes necessary to restore balance to the playing field. Japan understood that very well—and fostered through MTII the kind of shared research we're now seeing here in MCC and Semattech.

Whether Sematech will provide the dege that U.S. companies need to survive and prosper is hard to predict. But finally devoting cash and serious attention to manufacturing technology is a hopeful sign. The U.S. cannot regain the world's technological leadership with a nineteenthentury model of cooking up great ideas there, then shipping the work of making hinses off to the colonies.

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CD-ROM 1988: DÉJÀ VU ALL OVER AGAIN



The CD-ROM industry keeps promising a cascade of software and information. Why does the "torrent" still look like a slow-moving creek?

6 6 The Industry Emerges" was the official theme Microsoft picked for its third annual CD-ROM conference last February. A better choice might have been Yogi Berra's timeless remark, "It's déjà vu all over

again." The industry is emerging, all right, but at the pace of turtles in sludge. Just about everything I said about CD-ROM a year ago ("CD-ROM Chickens and CD-ROM Eggs," PC Magazine, June 23, 1987) still applies. Software and hardware manufacturers

continue to offer the tired "chicken and egg" metaphor as their excuse for why CD-ROM's penetration keeps failing to measure up to gurus' predictions. But cheap chickens are clearly the missing link; though software can sell hardware, it can't cut through consumer resistance to apparent price-gouging.

Player prices dropped only about \$100 from last year, putting the average model at about \$1,000 list-a \$600 street price at best. No matter how often manufacturers trot out their arguments about the high cost of the yen and short-run production, customers smell a rat when they see snazzy CD audio players selling for 150 bucks at Crazy Eddie.

The customers are almost certainly right. Aside from the drive makers, just about everybody connected with the business says the difference between a CD audio player and a CD-ROM player is a couple of chips and a controller cardpeanuts. The hardware companies have apparently decided to recoup their research costs from high-rolling institutional cus-

tomers rather than by making the CD-ROM a popular low-margin commodity. Interesting strategy, but the rat still stinks.

CHEAP RAZOR Why doesn't some software Gillette introduce a cheap razor to stimulate demand for its CD-ROM blades? A fellow from Microsoft replied that his company isn't in the hardware business. And the Microsoft mouse? That, he explained, was intended to drive software sales and uh . . . gee

My guess is, Microsoft thinks it would get whinsawed in the hardware price war that giant Japanese suppliers would wage the minute competition heated up. Too bad. Atari has announced a CD-ROM player at \$600 list, but it'll be compatible only with Atari computers. Apple, on the other hand, introduced its CD-ROM drive at a suggested retail price of \$1,200 and had the gall to claim "market leadership."

Apple's announcement did give the

technology an official corporate benison. By contrast, the CD-ROM demonstration in IBM's tiny booth included a huge sticker pointedly disclaiming any IBM endorsement of the drive or even the technology.

TOO TINY? Maybe IBM is onto something. One new CD-ROM trend is software spanning multiple disks-and multiple-disk-player banks. It's not hard to deduce that the half-gigabyte capacity of CD-ROM is actually too small for many uses-leaving it ripe for competition from more-capacious media, particularly erasable ones. If cheap CD-ROM players don't create a standard soon, they may well be leapfrogged by something designed from the ground up for data storage rather than for hanging digitized Dylan from one's belt loop. Or even by another belt-loop technology: digital audio tape.

Still, some interesting software did appear. Apple demonstrated lots of fuzzycute Hypercard applications, complete with audio. There's even a Mac edition of the definitive Webster's Ninth New Collegiate Dictionary with pictures, phonetic characters, and audio pronunciations-all of which Microsoft's Bookshelf dictionary lacks. It's an awfully persuasive demonstration of why Bill Gates and others are hastening to abolish text mode and usher in the sound-and-graphics age for IBM PCs.

Graphics, including maps, are at the heart of LaserScan Systems' RealScan program, which actually manages to make real-estate software exciting. (Did I really say that?) Demonstrated on the Macintosh but also available on IBM PCs, this little



■ STEPHEN MANES

gem delivers extensive property information and analysis tools to manipulate itfor example, to estimate the market value of a property from data on comparable holdings. RealScan is now a regional prod-

uct, available for two counties in Florida, with the rest of the state on the way. It's gratifying to see a technology like CD-ROM serving local folks, rapacious land developers though they may be.

Lots of other CD-ROM software takes public-domain (i.e., government) data as its starting point. Microsoft announced Stat Pack (a collection of government statistics) and Small Business Consultant (a collection of government documents). Geovision and Supermap use government data to produce geographic and demographic mans. Maybe Uncle Sam should get into the software biz.

Then there's the phone book. NYNEX showed its Fast Track, a CD-ROM phone directory that lets the laser do the walking so people can find you fast in just about every conceivable way. What a boon to telemarketers! How glad I am that I'm not in it! Publicity about this product should boost NYNEX's revenues-for unlisted number service. Eventually the New York listings will fit on a single floppy disk

A variety of indexing and retrieval schemes were on display. The estimable Personal Librarian, which can perform exceptionally sophisticated searches even when you don't know exactly what you're looking for, has now been dressed up with a Windows interface and a bost of new features. Last year it was an unsung hero; at \$600 in its snappy new guise, it seems poised to become an industry standard for databases on CD and off.

GE's DVI CD video system has improved considerably. Beta versions of PC AT board sets and software are on their way to developers, and they seem cheap at under \$10,000; the problem will be getting players out the door for a whole lot less. Lotus, Intel, and Microsoft have officially endorsed the DVI system.

But then, they're effectively frozen out of the international CD-I standard which uses a non-Intel microprocessor and a non-Microsoft operating system. In its first public demonstration, CD-I revealed itself as mostly a home entertainment product that adds digital (but not full-motion, fullscreen) video to a CD player at what should eventually be a reasonable price. It thus has more in common with LaserDiscs than with CD-ROMs or computers.

Still, the I in CD-I stands for "interactive"-the term that, exhumed from the Tomb of the Unsold Atari Game Cartridge, competed with "hypermedia" for the title of "This Year's Unofficial Buzzword." But that's another story.



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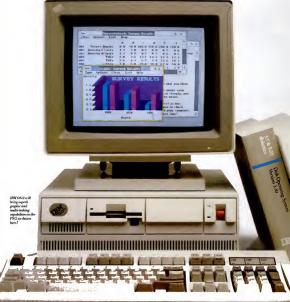
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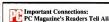
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What is a "typical" LAN? To find the answer, we conducted a survey over PC Magazine's Interactive Reader Service. More than 900 callers replied to this survey, which yielded some unexpected results.

One of the first things apparent from the responses is that the most sommon LAN (26 percent) connects on more than 10 PCs. Thirteen percent of our respondents have networks connecting between 26 and 100 PCs. Despite the publicity some companies have given to the concept of corporate or "enterprise" networks, our readers are using LANs at the small workgroup

Another interesting fact; our survey shows almost as many PCs with mainframe computer connections as with network connections. Nearly 63 percent of the people responding work in organizations with PCs connected to mainframes; of these, 13 percent report having over 250 PCs with mainframe connections Among those respondents with networks, more than half of the networks have a gateway to a mainframe or minicomputer. IBM 3270 SNA coaxial attachment and 3270 remote modern attachment are the most popular gateway connections (21 percent and 19 percent, respectively). We were surprised at the low responses (4 percent each) for IBM 3770/3780 and IBM 5250 (System 36) attachments. Sales figures typically show more interest in these connection schemes than our survey indicates. Among network connection

schemes, we were surprised at the growth of Token-Ring. Eighteen percent of our respondents reported using the Token-Ring system—the same percentage that reported using the traditional Ethernet system as

supplied by DEC and Xerox, among others. An additional 15 percent cited 3Com's EtherLink system as their LAN hardware. ARCnet trailed with a respectable 13 percent, end AT&T's StarLAN came up out of the statistical

noise level with a 6 percent return. Sixty-one percent of the respondent installed their own cabling, and 20 percent had cabling installed by a separate contractor. Only 10 percent of the respondents said that one contractor installed the cabling.

of the respondents said that one contractor installed the cabling, hardware, and software for their network.

In the area of networking software, Novell's NetWhen is the clear winner among our respondents. Novell got the not from 27 person of our respondents. Novell got the not from 27 person of our respondents of the notation of

Approximately how many PCa are installed at your company?



How many PCs have direct connections to a mainframe computer (typically through an IRMA board or similar device)?

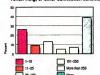


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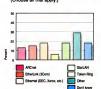
How many PCs are connected to each other in some way for file transfer, printer sharing, or DBMS work?



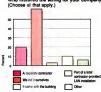
How many PCs are connected on a traditional local area network using Ethernet, ARCnet, Token-Ring, or other connection schemes?



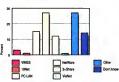
What connection scheme(a) do you use? (Choose all that apply.)



Who installed the wiring for your company's LAN? (Choose all that apply.)



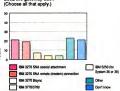
What networking software do you use? (Choose all that apply.)



Does your network include a gateway to a mainframe or minicomputer?



What kind of communications scheme does the gateway use?



percent in units from the last quarter of 1986 to the same period in 1987. The emphasis that DEC, Apple, and AT&T have placed on PC-based networks has also helped to motivate LAN buyers while significantly challenging IBM.

And though the 1987 LAN market is not typically price sensitive, this period of new stability has seen prices for individual adapter cards (with the exception of IBM's Token-Ring adapters) fall from the \$500-to-\$600 range to the neighborhood of \$200 to \$300.

THE SOFTWARE FRONTIER The increasingly broad installed base of corporate users has put pressure on software developers to port higher-end capabilities commonly found in minicomputer software to PC-based networks. Although people typically think of hardware when they think of LANs, the networking software is the biggest factor determining the response time, the flexibility, and the practicality of any network. Software determines how printers, files, and other resources are used, and right now this software market is booming. Industry pulse-takers report that sales of network operating software will reach about \$500 million by 1990

In the past, PC Magazine has focused most heavily on reviews of LAN hardware. In response to the new industry emphasis on software, this issue goes farther, presenting a comprehensive picture of the categories, features, benefits, and failings of PC-based LAN software.

The heart of the LAN software is the operating system. Our reviewrs spent several months reviewing and benchmark-testing the 13 operating systems markets, tighent mainly for Pc-based networks. These systems include EasyNet, LANtastic, Lighent, Network-OS, Omnined PC/INOS, Pc LAN, SFT NetWare 2-1, Tapestry, IONET, 3-8hare, TOPS, ViaNet, and VINES.

While networking software is mivisible to the end user, system administrators are happily discovering that new releases from LAN major-leaguess like Novell, Barris, Systems, and 10NET Communications of-fer them more support. Microsoft, 3Com, and their coterio of MS-Net resellers are hard at work on software releases scheduled for late 1988.

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Roberto Rivera has a B.S. degree in computer science from George Mason University. A member of the LAN evaluation team and a frequent contributor to PC Magazine, he is a project manager for a systems integration company in Washington, D.C.

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MODERN NETWORK MANAGEMENT Once the network is operational, the tasks of maintaining, configuring, and controlling it typically fall on the shoulders of one person: the network administrator. Although it's still true that the most important qualification of a network administrator is a strong knowledge of DOS, in large organizations or professional service offices the administrator may also run a profitand-loss center and be required to make important resource management decisions. Thus, in order to succeed, the thoroughly modern network administrator must have the skills of the computer hacker, the accountant, and the production foreman

Some modern network operating systems are trying to help. The latest releases of networking software from Novell and Banyan offer significantly enhanced capabilities for network troubleshooting, activity monitoring, security, and resource control. Novell also provides an excellent means of billing users for the use of network resources.

Since the majority of network operating systems don't help the administrator install applications, keep track of users, or audit and bill for network services, network

management utility programs are valuable commodities. Nevertheless, you'll be surprised to find far fewer of these programs than you'd expect, considering the complexity of the tasks network managers face.

Later in this special issue we begin a review of the add-on management tools that are available today.

LAN PRODUCTIVITY TOOLS The LAN can and should have the same salutary effect on workgroup productivity that a PC can have on personal productivity. A new category of product has emerged, designed specifically to take advantage of a LAN's inherent productivity-boosting

Many of these products have an e-mail program at their core and attempt to improve the productivity of workgroups by giving them better and more-structured (some would even say "Big Brotherish") tools for communications. In this issue, we review 17 of these software programs, including Higgins, Workstation Wizard, and The Coordinated to the programs of the confidence of the programs of the confidence of the programs of the programs of the confidence of the programs of the p

So read on. We'll help you take your pick of the packages available in today's LAN frontier—the software market.

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COVER STORY FRANK J. DERFLER, JR.

The brave new world of connectivity has some strange words in it. If you've found yourself tripping over a web of acronyms and buzzwords thicker than the cables above your suspended ceiling, this guide to networking terminology is required reading.

efore you can understand networking, you've got to speak the language. At the very least, the next time your boss asks whether you think the company should migrate to SAA, you should know that he's not talking about moving corporate headquarters south of the border. The following guide will help demystify the acronyms and buzzwords that industry insiders toss around so glibly.

Since you need a structure to hang the acronyms and buzzwords on, you first have to know about the ISO and its OSI model. The International Standards Organization (ISO), based in Paris, develops standards for international and national data communications. The U.S. representative to the ISO is the American National Standards Institute, or ANSI. In the early 1970s, the ISO developed a standard model of a data communications system and called it the Open System Interconnection (OSI) model.

The OSI model, consisting of seven layers, describes what happens when a terminal talks to a computer or one computer talks to another. This model was designed to facilitate creating a system in which equipment from different vendors can communicate. (If you want to know more about OSI, an excellent source is Omnicom, of Vienna, Virginia (703-281-1135). This firm supplies OSI training tools, including publications, videotape courses,

The other data communications models are IBM's System Network Architecture (SNA) and DEC's DEC Network Architecture (DNA), which both predated the OSI model. Both companies now equate

and private seminars.)

their systems more or less (DEC more and IBM less) with the OSI model and promise OSI compatibility.

PROTOCOLS Most of the buzzwords we will describe are protocols. Like the signals that a baseball catcher and pitcher exchange for pitches, protocols represent an agreement among different parts of the network on how data is to be transferred. Though you aren't supposed to see them and only a few people understand them, their effect on system performance can be spectacular. A bad protocol can slow data transfer, but a good one can make commu-nications possible between dissimilar systems. For instance, the TCP/IP protocol allows you to transfer data between computers having different architectures and operating systems.

The key elements of a protocol are synus, manufes, and timing. The syntar specifies the signal levels to be used and the format in which the data is to be sent. Semantics encompases the information needed for coordination among machines speed matching (so that a computer with a 9,000-bit-per-coord port can talk or with a 1,200-bys port) and proper sequenine of data if it arrives out of order.

Protocols describe all these functions. Since protocols are implemented in real products, though, they often don't fit the ideal description of the OSI model—either because the product predates the model or because its engineers couldn't resist adding that extra filtel tweak.

LAYER CAKE Think of the OSI model as a layer cake. At the bottom, holding everything else up, is the physical layer—the easiest one to point to. It's the wiring and cables.

The physical layer furnishes electrical connections and signaling. Subsequent layers talk through the physical layer. Twisted-pair wiring, RS-232C cable, fiber-optic strands, and coaxial cable are all part of the physical layer.

Probably the most common standard in the physical layer is RS-232C, a wiring and signaling standard that defines which pin does what, and when a voltage level on a wire represents a 1 or a 0. A new standard called RS-449 is supposed to replace RS-232C eventually. Europeans use an international standard called X.2 II bath's a lot like RS-232C. All of these are physicallaver standards.

The physical layer carries the signals for all the higher layers. Pull the plug and you won't communicate at all. But without the higher layers, you won't have anything to say. The higher in the OSI model you go, the more meaningful the communication is to the end user.

DATA-LINK LAYER Once you make the physical and electrical connections, you must control the data stream between your system and the one on the other end. The data-link layer of the OSI model works like the foreman of a railroad yard putting together cars to make up a train. This functional level strings characters to

gether into messages and then checks them before putting them on the tracks. It may also exchange an "arrived safely" message with the foreman in the other yard, or work with the other yard to reconstitute a message when a data disaster strikes.

The data-link layer uses many protocols, including High-Level Data Link Control (HDLC), bisynchronous, and Advanced Data Communications Control Procedures (ADCCP). But you don't need to know the details of any of these protocols—just picture them putting data trains

Since protocols are implemented in real products, they often don't fit the description of the OSI model—either because the product predates the model or because its engineers couldn't resist adding that extra little tweak.

on the right tracks and making sure they arrive safely. In PC-based communications systems, special integrated circuits on interface cards (instead of separate software) typically perform the function of the datalink laver.

Certain programs in PC data communications act like data-link-layer protocols. If you use Xmodem or Crosstalk to do error detection and retransmission file exchange, you're using an application program of the protocol while it is transferring a file.

NETWORK LAYER Large networks typically offer anumber of ways to move a string. The charters (put legalet by the feel fills, layer from one geophic point to another. For example, you can switch it through Detroit. The third layer of the CRI model—the network layer—decides which physical pathway the data should take based on network conditions, priori-

ties of service, and other factors.

The network-layer software usually resides in switches out in the network out in the network of the interface card inside your PC must put the train together in a way that the network software can recognize and route. In train tional PC-s-DC networks the network layer isn't important. But if you use Northorn Telecom's powerful Merdidan LAN-Star/PC network or value-added carriers ite Tyment, Telenet, Accuset, or CompuServe, they're providing such networklayer starvices for the providing such networklayer starvices for the providing such networklayer starvices for the providing such network-

TRANSPORT LAYER The transport layer-layer 4 of the OSI model-does many of the same jobs as the network layer, but it does them locally. Drivers in the networking software perform the transport layer's tasks. This layer is the railroad yard dispatcher who takes over if there is a wreck out in the system. If the network goes down, the transport-layer software will look for alternate routes or perhaps save the transmitted data until the network connection is reestablished. It handles quality control by making sure that the data received is in the right format and in the right order. This formatting and ordering capability becomes important when transport-layer programs implement connec-

tions among dissimilar computers.

The data-link layer can count boxcars to see if they are all there. The transport layer opens them up to see if anything is missing or broken. If layers 2 and 3 are doing their jobs right, linking and prioritizing, layer 4 doesn't have much to do.

PC-based LANs use several transportlayer protocols. One of the most common is the Transmission Control Protocol, developed by the Department of Defense and now adopted and marketed by many companies as part of the TCP/IP protocol suite.

SESSION LAYER Layer 5, the session layer, is often very important in PC-based systems. It performs the functions that enable two applications (or two pieces of the same application) to communicate across the network, performing security, name recognition, logging, administration, and other similar functions.

Two commonly used software products that perform session-layer functions are NetBIOS and APPC. We describe both of

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■ NETWORKING TERMINOLOGY



A Glossary of Networking Terms

Access protocol
The traffic rules that LAN workstations abide by to avoid data collisions when sending signals over shared network media. Common examples are Carrier Sense Multiple Access (CSMA) and token passing. Also referred to as the Media Access Controt (MAC) protocol.

■ APPC

Advanced Program-to-Program Communications This tBM protocol is analogous to the OSt model's session tayer, since it sets up the necessary conditions that enable application programs to send data to each other through the network.

■ APPC/PC

An IBM proet that implements APPC in a PC.

■ Application layer

(seventh) level of the OSI model. It describes the way that application programs interact with the network operating system.

■ ARCnet Attached Resources Computing. A networking

architecture (marketed by Datapoint and other vendors) using a token-passing bus architecture, usually on coaxial cable. It is generally implemented in the chips and connectors on the network adapter card.

A type of product that links different local area networks, enabling users on one network to use all the resources available on the other

■ Buffered repeater A device that aniplifies and regenerates signals so

that they can travel farther along a cable. This type of repeater also controls the flow of messages to prevent collisions.

"broadcast" arrangement in which all network stations receive the same message through the cable at the same time.

An amount of RAM set aside to hold data that

network stations are expected to access again. The second access, which comes from RAM, is very fast.

■ Coax or coaxial cable

A type of network media. Coaxial cable contains a copper inner conductor surrounded by plastic insulation and then a woven copper or foil shield.

■ CSMA

Carrier Sense Multiple Access. A media-sharing scheme in which stations fisten in to what's happenine on the network media: if the cable is not in use. the station is permitted to transmit its message. CSMA is often combined with a means of performine collision detection, hence CSMA/CD.

■ Data link laver

The second layer of the OSt model. Protocols functioning in this layer manage the flow of data leaving a network device and work with the receiving station to ensure that the data arrives safely.

■ 802.X

Institute of Electrical and Electronics Engineers (IEEE) committee that developed a set of standards describing the cubling, electrical topology, physical topology, and access scheme of network products. In other words, the 802.X standards define the physical and data-link layers of LAN architectures. IEEE 802.3 is the work of an 802 subcommittee that describes the cabling and signaling for a system nearly identical to classic Ethemet and its derivative, StarLAN, tEEE 802.5 is from another subcommittee and similarly describes tBM's Token-Rine

■ Ethernet A network cable and access protocol scheme origi-

natly developed by Xerox, now marketed mainly by DEC and 3Com

■ Fiber optics A data transmission method that uses light pulses

sent over glass cables. File lock

■ File server A type of server that holds files in private and shared subdirectories for LAN users. See also server.

A portal through which networked stations can

■ Frame

A packet on a Token-Ring network.

access resources on mainframe and minicomputer hosts as well as on nationwide data networks.

■ IEEE 802.X standards

network Protocol Exchange. A subset of the XNS protocols used by Novell in NetWare.

The Seven-Layer OSI Model for Network Communications: Where All the Buzzwords Fit In

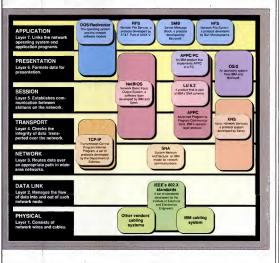
With the seven-layer model represented here, called Open System Interconnection (OSI), the International Standard Organization (ISO) has mapped out a set of standards that define a common language through which computers can talk to other computers over a network Dozens of companies and committees are working to create protocols and products-identified by all kinds of acronyms and buzzwords-that will meet the

standards of the OSI model Don't assume for a minute that real products tit this model so neatly. Though the ISO might think the world is orderly and structured, it just isn't. Engineers and designers often create protocols and products primarily to perform the functions of one layer, but they often can't resist tossing in a few features from another layer. For instance, although NetBIOS can reside in the transport layer by acting as an interface between the network operating system and the adapter cards, it is most commonly found at the session layer, where application programs use it to exchange data with other applications.

Here we show some of the products and protocols that follow the OSI standards. The lighter-colored boxes show the orimary area where each fits in, and the larger, darker, underlying boxes indicate the areas into which the protocol or product's functions extend.

■ ISO

International Standards Organization, Paris, which developed the Open System Interconnection (OSI) model



■ Locking
A method of protecting shared data. When an
Statistic momentum innerse a file. file locking either bytes in a file for various purposes. Since DBMS prevents simultaneous access by a second program or limits such access to "read only." DOS Versions

programs interpret this range of bytes as a record, this is called record locking.

■ LU 6.2 Logical Unit 6.2. In IBM's SNA scheme, a software product that implements the session-layer convertion specified in the Advanced Program-to-Program Communications (APPC) protocol.

(continues)

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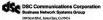
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A Glossary of Networking Terms (continued)

MAC Media Access Control. See access protocol.

MAP nufacturing Automation Protocol. A token-pass-

ing bus LAN designed by General Motors. Media The cabling or wiring used to carry network signals

Typical examples are coax, fiber-optic, and twistedpair wire.

■ NetBIOS Network Basic Input/Output System. A layer of software originally developed by IBM and Sytek to

link a network operating system with specific hardware. It can also open communications between workstations on a network at the session layer. Today, many vendors either provide a version of NetBIOS to interface with their hardware or emulate its session-layer communications services in their network products.

■ Network layer

The third level of the OSI model, containing the logic and rules that determine the path to be taken by data flowing through a network. Not important in small LANs.

NFS

Network File System. One of many distributed file system protocols that allow computers on a network to use the files and peripherals of another networked computer as if they were local. This protocol was developed by Sun Microsystems and adopted by other vendors

OST

Open System Interconnection, A model developed by the ISO describing the network communications process.

■ Packet

A block of data sent over the network transmitting the identities the sending and receiving stations. error-control information, and a message.

■ Peer-to-peer resource sharing A software architecture that lets any station co ute resources to the network while still running local application programs.

Physical layer
The first layer of the OSI model. It consists of network wiring and cable.

■ Presentation layer

The sixth layer of the OSI model, which formats data for screen presentation and translates incompatible file formats.

Print server

A computer on the network that makes one or more attached printers available to other users. The server usually requires a hard disk to spool the print jobs while they wait in a queue for the printer.

■ Protocol

A specification that describes the rules and procedures that products should follow to perform activities on a network, such as transmitting data. Protocols allow products from different vendors to communicate on the same network.

Record lock ■ Redirector

A software module loaded into every network workstation. It captures application programs' requests for file- and equipment-sharing services and routes them through the network.

■ Repeater

A device that amplifies and regenerates signals so they can travel farther on a cable. Remote File Service. One of the many distributed

RFS file system network protocols that allow one com-

puter to use the files and peripherals of another as if they were local. Developed by AT&T and adopted by other vendors as a part of UNIX V.

A machine in a large network that reads the destina-

tion of a message and selects the best route. See network layer.

■ SAA Systems Application Architecture, A set of specifi-

cations written by IBM describing how users, application programs, and communications programs interface. SAA represents an attempt to standardize the look and feel of applications.

Server

 A computer with large power supply and cabinet capacity.
 Any computer on a network that makes file, print, or communications services available to other network stations.

Session layer The fifth layer of the OSI model, which sets up the conditions whereby individual nodes on the network can communicate or send data to each other. The functions of this layer are used for many purposes, including network gateway communica-

SMB Server Message Block. A distributed file system

network protocol that allows one computer to use the files and peripherals of another as if they were

local. Developed by Microsoft and adopted by IBM and many other vendors.

SNA

System Network Architecture. IBM's model of a communications system.

■ StarLAN

A networking system developed by AT&T that uses CSMA protocols on twisted-pair telephone wire. A subset of 802.3.

■ TCP/IP Transmission Control Program/Internet Program. A set of protocols developed by the Department of

Defense to link dissimilar computers across large networks.

■ Token passing
An access protocol in which a special message (token) circulates among the network nodes giving

them permission to transmit.

■ Token-Ring Refers to the wire and the access protocol schem whereby stations relay packets around in a logical ring configuration. This architecture is described in

the IEEE 802 3 standards ■ Topol

The map of the network. The physical topology describes how the wires or cables are laid out, and the logical or electrical topology describes how the messages flow.

■ Transport layer The fourth layer of the OSI model. Software in this layer checks the integrity of and formats the data

carried by the physical layer (1), managed by the data layer (2), and perhaps routed by the network layer (3).

■ Twisted-pair wiring Cable comprised of two wires twisted together at 6

turns per inch to provide electrical self-shielding. Some telephone wire - but by no means all - is twisted-pair.

■ X.25

An international standard describing how comput ers can access packet-switched networks. Typical X.25 networks include Tymnet, Telenet, and MCI

Mail XNS Xerox Network Services. A multilayer prote

system developed by Xerox and adopted, at least in part, by Novell and other vendors, XNS is one of the many distributed file system protocols that allow network stations to use other computers' files and peripherals as if they were local.

- Frank J. Derfler, Jr.

these products later on; for now, all you need to know is that these pieces of software reside in every network station and pass calls between application programs in the network. The primary applications that make use of session-layer communications are network gateway programs.

PRESENTATION LAYER As soon as you start using blinking characters, reverse video, special data entry formats, graphics, and other features on the screen, you get into the presentation layer. This layer may also handle encryption and some special file formatting. It formats screens and files so that the final product looks the way the programmer intended.

The presentation layer is the home of control codes, special graphics, and character sets. Its software controls printers, plotters, and other peripherals. For microcomputers, this layer is the home of terminal emulators that make an IBM PC think it is a DEC VT-100 or IBM 3278 terminal.

APPLICATION LAYER The top of the layer cake-the application layer-serves the user. It's where the network operating system and application programs reside-everything from file sharing, print job spooling, and electronic mail to database management and accounting. The standards for this top layer are few, and they usually apply only within a particular line of software products. Yet this layer is the most important one because the user controls it directly.

Some functions, such as file transfer protocols, work from the application layer but do jobs assigned to a lower layer-somewhat akin to the president of the railroad sometimes having to sweep out boxcars

That's it-the top of ISO's OSI model. The concepts are pretty easy, but dozens of committees are working to define standards for little pieces of each layer, and great political fights are being waged over whose ideas should prevail. Let's go on to hang some buzzwords on the model and see where they fit.

IEEE 802.X STANDARDS The Institute of Electrical and Electronics Engineers (IEEE) developed a set of standards describing the cabling, electrical topology,

physical topology, and access scheme of network products. The committee structure of the IEEE is numbered like the Dewey decimal system. The general committee working on these standards is 802. Various subcommittees, designated by decimal numbers, have different versions of the standards.

These standards describe the protocols used in the lower two lavers of the OSI model. They don't go above those layers; thus, using the common name of one of the IEEE standards (like Token-Ring) is an incomplete response to the question, "What network do you use?" (You must also specify the network interface, including

Some functions work from the application layer but do jobs assigned to a lower laver-somewhat akin to the president of a railroad sometimes having to sweep out boxcars.

the networking software.)

You'll hear about two IEEE 802 committee standards that relate to PC-based LANs: 802.3 and 802.5. IEEE standard 802.5 describes the Token-Ring architecture. The work of a committee that received a lot of attention and leadership from IBM, this standard describes a tokenpassing protocol used on a network of stations connected together in a special way, combining an electrical ring topology (where every station actively passes information onto the next one in the ring) with a physical hub topology.

the media and access protocol as well as

IBM's Token-Ring system is becoming more important to corporate ADP managers because IBM supports an increasing number of mainframe computer Token-Ring interfaces. Under IBM's Systems Application Architecture (SAA), mainframes and PCs share data as peers on networks.

An increasing number of vendors, like Proteon, make Token-Ring interface cards for popular minicomputers. They allow easy interaction without resorting to complex and expensive micro-to-mainframe links and gateways.

IEEE 802.3 on the other hand describes a standard that owes a lot to the earlier Ethernet system. It uses carrier sense multiple access (CSMA) signaling on an electrical bus topology. The standard leaves room for several wiring options

The 802.3 committee is currently a hotbed of activity. Vendors like 3Com, Synoptics, and Hewlett-Packard (HP) have different methods of supplying 10MB-persecond service on twisted-pair wiring, and each is maneuvering to have its own method accepted as a standard.

Meanwhile, the 802.3 standard (particularly as represented by slightly variant Ethernet systems produced by DEC, HP, Xerox, and 3Com) is extremely popular. You can buy 802.3 interface cards for the PC from a dozen or more manufacturers. Similar cards designed for popular minicomputers are widely available. IBM even includes an optional Ethernet port on its newest mini/mainframe computer, the

While the 802.X standards don't describe every popular network cabling and access protocol scheme (ARCnet, for instance, is not a perfect fit), "eight-oh-twodot-something" is a frequently used expression that you should know.

IBM'S CABLE PLAN Another shorthand used by LAN writers and speakers is derived from IBM's cabling scheme. The major vendors-AT&T, DEC, Northern Telecom, and others-have their own wiring schemes. Not unlike Chinese masters of the art of Fung Shui who combine engineering, ecology, and mysticism, these vendors all want you to wire your buildings in certain ways that are advantageous for their equipment and that will keep the other dragons (the competing vendors) away from your door.

The IBM cabling plan, like most things IBM, is comprehensive, capable, and expensive to install. IBM has developed standards for certain types of cables, and it certifies certain manufacturers as meeting those standards. Here's a quick reference:

- Type I Cable: Shielded cable with two twisted pairs made from solid wire (as opposed to stranded wire in type 6 below). Used for data transmission, particularly with Token-Ring networks.
- Type 2 Cable: Four unshielded pairs of solid wire for voice telephone and two shielded data pairs in the same sheath.
- Type 3 Cable: Four unshielded solid twisted pairs for voice or data. IBM's version of modern twisted-pair telephone wire.
- Type 4 Cable: No specification published. Must be used to connect Model 40 PS/2s together.
- Type 5 Cable: Two fiber-optic strands. ■ Type 6 Cable: Shielded cable with two twisted pairs made from stranded wire. More flexible than type 1 cable. Designed for data transmission; commonly used between a computer and a data jack in the
- wall.

 Type 7 Cable: No specification pub
 - lished.

 Type 8 Cable: A special "under-thecarpet" shielded twisted-pair cable designed to minimize the lump in the carpet that covers it
 - Type 9 Cable: Plenum cable. Two shielded twisted pairs covered with a special flame-retardant coating for use between floors in a building.

STRENGTHENING SKOVALS Signals cun travel only limited distances before losing steam. For instance, a signal on an Ethernen network can typically travel up to 1,000 feet; one on a Token-Ring system, up to about 600 feet. Networks use repeaters, bridges, routers, and gateways to strengthen signals traveling long distances and to talk to other LANs or wide-area networks.

Repeaters amplify and regenerate signals for the network, allowing them raved greater distances. In addition, repeaters have elevarious continuity, which way on which data can travel in two directions, but with no regulating traffic lights. Two signals simultaneously attempting to traverse the same stretch of road in opposite directions will collide.

Buffered repeaters also extend the operational distance that the network can cover. But this type of repeater breaks the

electrical continuity of the network. Buffered repeaters act like the one-lane highway described above but use a traffic light to control data flow and prevent collisions.

to control data flow and prevent collisions.

Bridges allow you to join two local area
networks, and they allow stations on either
network to access resources on the other.
Unlike repeaters, bridges don't regenerate
signals or control the access protocol.

Gateways, which run on the OSI session layer, allow networks running totally incompatible protocols to communicate. True X.25 gateways are a good example.

Some LAN system vendors want you to wire your buildings in ways that are advantageous for

their equipment and that will keep competing vendors away from your door.

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In PC-based networks, gateways typically link PCs to host machines such as IBM mainframes.

HIGHER-LEVEL PROTOCOLS Moving up through the OSI model's layers, let's look at the techniques (each with is own buzzwords) used by different LAN software suppliers for the layer 4 (transport) and layer 5 (session) protocols.

If you don't specify the transport-layer protecols you want to use, you'll get what-ever the vendor includes in its standard "protecol stack." These protecols may or may not be available for the various mainframes or minicomputers in your network. Selection of the proper higher-level protocols by managers of large corporate networks is a complex, important networks is a complex, important networks in a complex in protect network in a complex in protect networks in a complex in protect network in a complex in a compl

TCP/IP The earliest large network systems were fielded by the Department of Defense (DoD). The DoD financed the development of interactive network communications software for many different mainframes and minicomputers. The stan-

dard core of the DoD-specified software consists of programs that implement two protecols, called Transmission Control Program (TCP) and Internet Program (IP). The availability of TCPIP software and the continuing active enforcement of the protecols by the DoD (through software certification) makes them attractive to managers who face the challenge of intertrating dissimilar commuter systems.

graing dissimilar computer systems.
TCP and IP perform primarily what the
OSI model terms layer 4 (transport) functions. Particularly important is the ability
to communicate, translate, and order data
among two or more different computer
systems.

systems.

Companies like Excelan and Chi sell TCP/IP software customized for specific computers and controller cards. These software modules communicate through the network, recognize each other, and pass messages in a common format generated by the higher-level session layer and application programs.

TCP/IP software is popular with managers of large networks because it works and is available for many computers. Novell, 3Com, Banyan, and other vendors of networking software offer various options, ranging from standalone interface boxes to TCP/IP LAN gateways.

NETBIOS Another institutional solution now enjoying grast-roots support is NEBIOS. Sealed as an interface between the IBM PC Network Program (PCNP) supersided by PC LAV and netreface, they also not designed theinterface, they also noted is a programble entryway into the network, allowing systems to communicate over network hardware without going through the networking solyname.

A gras-roos movement of large-new users in now pushing a combination of NeBIOS (operating at the CSI session on application programs make calls to Net-BIOS. Vendors like Novell, 3 Comi, and Banyan don't actually use NeBIOS to drive network interface cards, but the view of the Nebios of the Nebios Nebios of the Nebios Nebios of the Nebios Nebio

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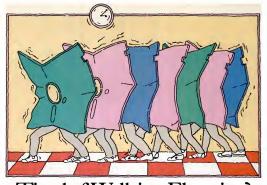




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communications sessions with each other across the network. However, NetBIOS has a simple naming scheme that doesn't work well between networks or in a wide variety of operating systems. The Internet Protocol portion of TCPIP packages the NetBIOS modules so that they travel intact through multiple levels of network names and addresses.

LAYER 4 AND ABOVE If you don't use TCP/IP and NetBIOS-or some rare laver 4 (network-layer) protocol complying with the ISO model-you enter a maze of vendor-specific protocols. If you use PCs only in a network working together or perhaps using a gateway for mainframe file sharing, you don't care what protocols the networking software uses. But if you want computers from IBM, DEC, HP, and other vendors to treat each other as peers on the network, and if you want to access files on the DEC from your PC's D: drive and files on the HP from your PC's H: drive, the network protocols you use become very important. (One caveat: these protocols don't make otherwise incompatible application files compatible; they just move them across the network and offer access to them.)

Each vendor engages other vendors to support its protocol in their products. What's important is that the set of vendors supporting a specific protocol matches the set of vendors whose equipment is used on your network.

IBM'S SNA AND APPC 1BM would like to wrap you in the Big Blue web called System Network Architecture. IBM's answer to the OSI model, SNA describes how IBM thinks a communications system should work.

Advanced Program-to-Program Communications (APC) is a protocol within the SNA model that establishes the conditions that enable programs to communicate across the network. APPC is analogous to the session layer of the CSI model. According to IBM, APPC is the communications basis for all of the communicature applications and systems products ture applications and systems products that actually implement the APPC/PC and LIA 62—are the names of products that actually implement the APPC specifications.

IBM'S SAA You can think of 1BM's Systems Application Architecture (SAA) as a stack of documents describing how things should be done. SAA describes application program interfaces (that look just like OS2's Presentation Manager), screen and keyboard standards, and communications protocols to operating systems and to facilities like APPC.

DECNET The other company that can drown you in a sea of acronyms is Digital Equipment Corporation. DEC developed

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Each vendor engages others to support its protcol, but what

counts is that the vendors supporting a specific protocol match those whose equipment is used on your network.

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its own protocol stack for interconnecting DEC systems both locally and over widearea networks. The DECNET protocols are supposed to be heading toward compatibility with the ISO standards. It seems likely that DEC will adopt certain ISO protocols (as will many other vendors) to beat the drum for their compatibility.

APPLE Apple has its own set of protocols in the Appletalk family. The Appletalk Filing Protocol is the one that allows distributed file sharing across the network. AFP is attached to the Hierarchical File System (HFS) in the Macintosh operating system.

DISTRIBUTED FILE SYSTEMS SMB, RFS, NFS, and XNS are acronyms for some of the contending distributed file system network protocols. Distributed file systems, which are a part of every network, allow one computer on a network to use the files and peripherals of another networked computer as if they were local. The two operating systems link so that a

subdirectory made available on the host is seen as a disk drive or as a separate subdirectory on the user's computer. Thus, application programs running on the user's computer can access the files and resources on the bost without requiring special programming.

These protocols operate in approximately the same way, but they are not interchangeable. Typically, a major vendor develops the protocol for use within a product line, and other vendors license it to achieve compatibility.

SMB stands for Server Message Block, a protocol developed by Microsoft and IBM that 's used in the IBM PC LAV program. AT&T, DEC, Intel, HP, Ungermann-Bass, and others all support or accommodate it to some degree.

RFS is the Remote File Service develped by AT&T. Since RFS is integral to UNIX V. Version 3, vendors in the UNIX market support in their products. RFS is implemented using the powerful visterams "facility in the System V.3, which allows applications to open a stream visterams" facility in the System V.3, which allows applications to open astroam across any defined transport-level interactors any defined transport-level intertion by the control of the definal UNIX transport services, or TEP. or some other protects.

NFS stanks for the Network File System, an architecture developed by Suhcrosystems. Sun's PC-NFS is a complex to the Oil File System for the PC. The memory-resident module gives you access to files stored on UNIXbased, minicomposers. Companies in the professional workstation market, including Texas Instruments, IPP, Harris, and many others, support the NFS architecture in their produces.

Largely because of its leading role in selling Ethernet products, Xerox has been successful in promoting its own Xerox Network Services (XNS). 3Com uses XNS in its 3+5hare software, and Novell uses a subset of XNS (called IPX) in its popular NetWare.

Although this primer on buzzwords and acronyms just scratches the surface of the compendium of networking terminology, it should help you gain a better understanding of the strange, new language of connectivity.

To some people, the difference is obvious.





product, especially if you need advanced features. It works just as well with a half-dozen spreadsheets simultaneously as it does with one. ??

power, ease of use, speed, and flexibility, you would be hardpressed to find a more capable

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COVER STORY

A FIELD GUIDE TO



OPERATING SYSTEMS

The fastest drives and interface cards are worth little without the right networking software to run them.

any people worry more about network interface cards and cabling than about operating systems. While they can usually specify that they want a server with fast disk drives and a processor, they don't know how to quantify, measure, or select networking software. But software can make or break a network.

Quie simply, modern networking software is what makes distant resources local. If you are interested in files that reside on a machine down the hall that acts as a server, the software enables you to access those files as if they resided on drives in your own machine. It lets you use printers locatied thousands of feet—or even miles away as if they were snugly attached to your own LPTI port. And it allows you to use network modems or even minicomputers as if they were cabled to your own COM1 port.

COM port.

Network perming systems have a multitosking and multiuser architecture; in that
have a multititosking and multiuser architecture; in that
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hand, take requests for services from many application programs at the same time and satisfy them with the network's resources—in effect, arbitrating requests for the same services from different users.

INVISIBLE AND MODULAR Ideally, networking software is invisible to the end users. When you use it, you know you have more resources available, but you usually don't care where the resources are

or how you are attached to them.
Structurally, networking software has
many modules. Most of them reside in the
machine that acts as the server for data,
printer, or communications resources. But
several important program modules must
be in every workstation or, sometimes, in



Networking Software/ Hardware Interaction

N etwork operating software, residing on every workstation and server, is a complex combination of modules that must work fogether. This diagrams have the bardware and software on the workstation (left) and the server (right). (For both workstation and server, the hardware ais the bottom level of the diagram; everything above that is software. Arrows represent the flow of measurements of the server of the

and the responses.)
The workstation is only a "client,"
with no capabilities for contributing
resources to other network stations. It
has the same PC hardware (disk drives,
monitor, keyboard, and so forth), BIOS
(Basic Input/Output System, the software
that links the hardware to DOS), and
DOS that all PCS have, whether

networked or not. For LAN operation, several additional (the interface cards and cables, tinted blue) and software (the redirector, NetBIOS, and driver software, tinted yellow). First, the application program running on the work-station may have certain added network attributes, such as the ability to issue record and file lock commands automatically through DOS. (This software enhancement is not strictly necessary, since even application programs not designed with a LNN in mind can run on a network.)

LAN in mind can run on a network.)
Second, the redirector module is added,
to intervene between the application
program and DOS. It intercepts software
interrupt 21 he alls generated when an application program asks DOS for services like

cation program asks DOS for services like file access. Each PC's redirector is programmed to switch certain calls—such as requests for data from drives that don't exist in the local PC's hardware—out through the network for service. Thanks to the redirector, a PC application can easily use network resources tast by addressine

the correct disk drive.

Another added software module, the interface card driver, moves data between the redirector and the workstation's network interface card. This driver software is

specifically designed for network interface card hardware. Some card the reference card hardware. Some card the reference is view tooks like the NeEBIOS program developed by IBM and Syrke to link their network hardware and software. If the driver is wrapped in a NeEBIOS interface, it fils the Microsoft redirector supplied with IBM's PC LIM and many other operating systems.

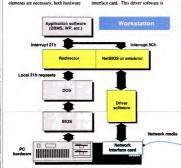
If the interface card driver doesn't perform the communications functions associated with NetBIOS, another software module usually emulates those functions. Application programs use a software interrupt 5Ch to call for session level communications services from the NetBIOS emulator or conforming NetBIOS of the program of the NetBIOS emulator or conforming NetBIOS of the services are programs of the NetBIOS of the

The network interface card sits in the expansion bus of the workstation. In modern networks, its wiring and its media access protocol are almost always independent of the networking software. The interface card includes programs in read-only memory that manage the creation and transmission of packets over the network.

At the other end of the cable from the workstation interface card is the server, with additional specialized L4N software and its own interface card. After the server interface card does its job, a NetBIOS module or emulator watches for packets containing NetBIOS information. Other messages pass to the security and multiluser software modules.

Like any other computer, the server DOS, but often a unique system—sometimes DOS, but often a unique system or one derived from the UNIX system. If the system is DOS, you can almost always run local application programs and use the computer as a network terminal. But remember, all server software requires a lot of processor RAM and attention.

Finally, network utility programs run on the server, offering print spooling, auditing, and other LAN features. —Frank J. Derfler, Jr.



devices posed between the workstation and the network. (See the diagram "Networking Software/Hardware Interaction.")

Working together, these program modules perform the basic actions of networking software. In a nutshell, networking software recognizes users, associates their preprogrammed privileges with their identities, and then reroutes their DOS requests to the appropriate server for action. The operating system software in the server frequently is not a variety of MS-DOS, but it must emulate DOS and respond properly to DOS requests routed from the workstations. (This admittedly facile description would probably make the developers of these systems protest; they use many different complex techniques to make networking software work, and have made large financial investments in developing technical standards.)

DIFFERENT SPECIES Darwin's method of categorizing strange critters—according to species and phylum—can also be applied to operating systems, which occur in two different species, each having different ancestors and largely different attributes. One species is derived from MS-DOS, the other has roots in mini-

computer operating systems like UNIX

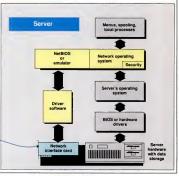
THE MS-DOS SPECIES MS-DOS is a weak basis for a network operating system, since it's not designed to be able to run multiple programs and satisfy many users simultaneously. Companies marketing DOS-based network software use patches and shell programs that intercept multiple requests, buffer them, and divide processor time among tasks. Some companies, such as Fox Research (now 10NET Communications) and Centram Systems (now TOPS, owned by Sun Microsystems), developed their own programs to modify DOS and give stations network capabilities. These programs represent separate branches evolving along parallel lines. The largest number of DOS-derived operating systems, however, are the vot of Microsoft. That company developed a set of programs for DOS-based network operating systems called MS-Net, and many vendors license pieces of MS-Net, and for their use. DEC, AT&T, 3Com, and IBM, for example, incorporate some part of their own forms and user interfaces. Some, like 3Com and DEC, add significant pieces of their own code, using only

small parts of MS-Net.

These DOS-based network operating systems share a number of characteristics. The most evident one is peer-to-peer resource sharing, the ability to allow any PC and the proper source sharing, the ability to allow any to add-on programs that offer multifunction capabilities were in the background mouches of the property of the

Peer-to-peer resource sharing is both a capability and a limitation. On the positive side, it allows great flexibility and makes these systems economical in installations having as few as two PCs. Since these operating systems can run on any of the Intel processors used in the PC family, even IBM PC-XTs or Model 30s can share their resources with other PCs. On the negative side, peer-to-peer resource sharing typically will slow response times, can stifle the growth of the network, and may make it more difficult to manage. When files and printers are spread among many machines acting as servers, administrative problems multiply.

In the evolution of the 3Com software away from its DOS roots, it lost peer-to-peer resource sharing, 3Com's 3+Share software is the only DOS-based operating system we can identify that requires a dedicated server. But, as we will discuss later, 3Com's software is being grafted back to the DOS tap root, since 3Com is cooperating with Microsoft in developing LAW-



Manager, Microsoft's next generation of networking software.

DOS-based systems (with the exceptions of IONET and LANIzatis Network Operating System) share another trait. RAM hunger, line 'unusual to lose I 20K or I 40K of RAM to the networking software in a workstation. Often buffers and code loaded on boot-up in the CON-FIG.SYS file use some of this space, so it's lost to DOS applications whether the network is in use or not.

If the workstation is configured to share resources with the network, some programs, like IBM's PC Local Area Network Program (PC LAN), can occupy nearly 400K RAM. A few specialized memory add-on products might allow the use of RAM outside of DOS's 640K for at least part of the networking software modules in some programs. 3Com's new EtherLink Plus and TokenLink Plus cards are designed to reduce some of the pressure on RAM by storing more program code on the networking card. Banyan Systems' VINES works with several RAM card products that use some of the open spaces in an AT's memory map. But generally you'll lose RAM space for application programs with almost all types of networking software.

The MS-Net-based programs also share a common command syntax. The 3Com programming syntax keeps its individuality by being at least connectional different from that of MS-Net. Some members of this species, like TOPS and Tappenry). Bedifferent command-line statements and syntax (scors in the case of Tappenry). Because the MS-Net young to specify the special programs and western cance the MS-Net young as special so widely, the special programs and western population to the program and western population and the special program and the special programs are special programs and the special programs are special programs and the special programs are special programs.

The standard features of the DOSbased operating systems vary widely. They all have menus and some kind of print job spooling and queuing capability, but most do not include electronic mail or network management functions. IONET, with its standard library of features such as mail, chat, and network statistics, is a notable exception. Torus Systems includes a nowerful e-mail canability in Tanestry.

A Decision Guide for Networking Software

If you are looking for a local area network operating system for a specific workgroup activity, the presence or absence of just one or two features can be the deciding factor. To help you

narrow your choices, we've listed typical networking activities, the features crucial to them, and the packages that offer those features.

VinNet

MICRO-TO-MAINFRAME AND WIDE-AREA-NETWORK INTEGRATION

(in a corporation or large organization)

Key features:	X.25, TCP/IP proto 3270 connectivity of Multiple file servers	options	
Products:	LifeNet - PC LAN SFT NetWare 2.	• Tapestry • 10NET 1 • 3+Share	ViaNet VINES
MODERATE WORD	PROCESSING SPREADS		BMS CAPABILITIES

(desidates

Key features: Economy
Easy stoces to applications
Easy stoces to applications
Printer sharing
Printer sharing
Products:

| Almastic | PC, AN | TOPS |

CONNECTING ISM RCs AND MACINTOSH COMPUTERS

Key hashres: File transfer
Heat disk drive sharing
Products: 9 3-Share • TOPS

COST TRACKING AND ACCOUNTING

(Polessarial dies et geschneck orderstad)

Key feetures:
Tracking network actify by uner
Bill-back to user's department

Produchs:

I Whassic = SFT NetWare 2.1 • VINES

CRITICAL FUNCTIONS
(Buch as income production, health, safety, or excurity)

Key features: Resistance to failure
Fault tolerance

Products: • LifeNet • SFT NetWare 2.1



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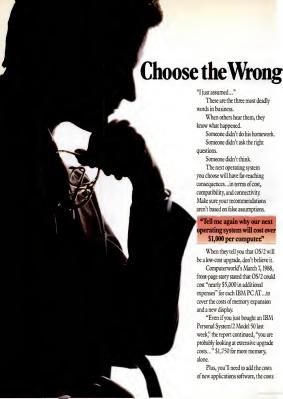
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AST Ethernet	576		
Western Digital EtherCard Pf	us* 534		
3Com ^o EtherLink*	235		
3Com EtherLink+	410		
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"I just assumed..."

These are the three most deadly words in business.

When others hear them, they know what happened. Someone didn't do his homework.

Someone didn't ask the right questions.

Someone didn't think. The next operating system you choose will have far-reaching

consequences...in terms of cost. compatibility, and connectivity. Make sure your recommendations aren't based on false assumptions.

"Tell me again why our next operating system will cost over \$1,000 per computer."

When they tell you that OS/2 will be a low-cost upgrade, don't believe it.

Computerworld's March 7, 1988, front-page story stated that OS/2 could cost "nearly \$5,000 in additional expenses" for each IBM PC AT ... to cover the costs of memory expansion and a new display.

"Even if you just bought an IBM Personal System/2 Model 50 last week," the report continued, "you are probably looking at extensive upgrade costs..." \$1,750 for more memory,

Plus, you'll need to add the costs of new applications software, the costs

Operating System...And You'll Pay.

of training, and the costs of the system.

All in all, a very expensive upgrade.

"How can you say this operating system is compatible...when half our computers can't even run it."

Take a look around at the mix of PCs your company uses.

Think one version of OS/2 can be used as a company standard?

Think again.

Because each brand of 80286 or 80386 PCs or PS/2s needs its own machine-specific version. And each version has its own set of hardware and software compatibilities.

8088-PCs are totally out of the picture, and PC-DOS programs don't run while you're interacting with an OS/2 application.

"So you're telling me that to play it safe, we should use the operating system's network... or use none at all."

Open architecture is what built the business PC industry...because it enables you to mix and match the best software with the best hardware for your specific needs.

Which makes you wonder just how smart it is to install an operating system designed for a specific network...
that may or may not be best for you.
That may or may not be compatible
with the networks you already have.
Our competition wants you to buy

it all from them. We give you a choice.

We give you a choice. So we're compatible with the networking standard: Novell.

We take advantage of the fastest software-driven network: I ANI ink 5XTM

And we work with the standard in micro-to-mainframe connectivity: Irma by DCA.

"What's this I've heard about operating systems designed for multi-user work groups?"

In short, they're the way of the future.

Because they address the very same needs that most concern you. Like cost, compatibility, and connectivity.

PC-MOS is a unique DOScompatible, multi-user operating system. It lets departments use inexpensive dumb terminals (or 8088-PCs running terminal emulation software) in combination with host computers.

Because it's multi-user, you can share a PC's data, programs, memory, and processing power with workstations costing under \$500, each. "If PC-MOS can save us over \$1,000 per user, why aren't we using it?"

Good question.

Because with PC-MOS, you get an operating system that lets you share your computers' resources instead of forcing you to spend up to \$5,000 per user upgrade.

PC-MOS was designed to be an operating system standard for the mix of 80286 and 80386 PCs in your company. So you don't have to worry about varying levels of compatibility among your PCs.

It's an operating system that provides compatibility with the hardware and software you have. And it provides a migration path to future applications which will take advantage of the 80386 processor's 32-bit mode.

PC-MOS is available for both 80286 and 80386 PCs and PS/2s.

It comes in single-user, five-user, and 25-user versions, starting at \$195, all of which include a money-back guarantee. For complete details, call The

Software Link at 1-800/451-LINK.

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PC-MOS/286TM, PC-MOS/386TM, and LANLink SXTM are restorated of The Software Link, Inc. PC-AT, PS/2, Personal System/2, PC-DOS, & OS/2 are transferants of IBM Corp. IRMA is a readment of DCA, Inc. Prices and technical specifications subject to change. Capyright ⊗ 1888. All Rights Reserved.

See us at COMDEN '88, Booth 1732 CIRCLE 393 ON READER SERVICE CARD and 3Com has add-on features in 3+Share. But many of these programs, like PC LAN, include only the basics needed for resource sharing. If you want electronic mail, group calendaring, or other productivity tools, you must buy them from third-party vendors.

THE UNIX SPECIES The other root of today's network operating systems is the minicomputer world. Minicomputer operating systems such as UNIX are designed from the beginning with multiuser and multitasking capabilities, Non-DOS LAN operating systems for networked PCs don't need patches or added modules to give them these capabilities. But they must still respond appropriately to DOS calls for services. The need to emulate MS-DOS (and other related elements such as Net-BIOS) sometimes leads to incompatibilities, particularly in out-of-step MS-DOS

and LANOS releases LAN operating systems derived from minicomputer stock include Banvan's VINES and Novell's NetWare. VINES has the greatest external resemblance to a minicomputer operating system. When you turn on a VINES server, the operating system describes step-by-step the programs it is initializing and running. Together, these programs constitute the network operating system on the server. The UNIX file structure is used on the hard disk, and UNIX controls the I/O ports on the server. While even the network administrator never directly addresses the UNIX operating system underlying VINES. UNIX is there performing the multiuser and multitasking functions so important to server operation.

In Novell's NetWare family of operating systems, the file structure of the server is unique to Novell, and arbitrary MS-DOS limitations on memory space and I/O port limitations don't apply to the server. Novell's Advanced NetWare/286 runs the 80286 processor in its protected mode, allowing efficient internal processing and external memory addressing.

Both VINES and NetWare use workstation software that is functionally similar to the MS-Net-based products. Software modules (NetWare calls them shells) running in each workstation communicate with the networking software on the server

to pass along DOS requests for service. Application programs or DOS commandline entries on the workstations generate the requests. The server software accepts the requests, checks the identity and the authority of the requester, translates the requests into messages the server operating system understands, and passes them to the server operating system. The server software also sends back the requested data and issues appropriate error codes to

the workstations The major difference between this species of operating system and the MS-DOSbased species is that the server software in the UNIX-based species takes care of mediating simultaneous requests for the same data and will also run multiple programs. The result is typically much faster performance. In addition, workstations in these systems are not able to contribute resources to the network. Only one or a small number of dedicated computers perform the role of "server"-filing, printing, or running communications. (A special version of Novell's NetWare designed for small installations allows the server to operate also as a workstation-but not vice versa.)

This type of network operating system is typically rich in accessories and management tools. You can expect to find network bridging, electronic mail, print spooling, remote workstation support, and other software modules, either in the standard release of the software or as inexpensive add-on modules supplied by the original manufacturer.

OPERATING SYSTEM FEATURES With the two broad species of networking

operating systems in mind, you'll want to consider the following features when selecting a particular system.

■ Dedicated servers vs. a shared solution. Network operating systems such as IBM's PC LAN, Sun Microsystems' TOPS, Torus's Tapestry, and 10NET Communications' 10NET allow any workstation to contribute drives, printers, and other resources to the network. Others, such as 3Com's 3+Share, Novell's NetWare, and Banyan's VINES, require a computer dedicated to the server role. The shared solution (also called peer-to-peer resource sharing) is appealing in small in-

stallations where the cost of a dedicated machine is a factor, but sharing a workstation's resources always slows down operation of local programs, and dedicated serv-

ers give faster network performance. ■ Special servers. Some network operating systems come in versions designed for non-PC-AT-type servers. VINES comes in an 80286 version, but Banyan's bestselling product runs on special servers using Motorola 68000 series processors. Both DEC and AT&T offer versions of their networking software allowing their minicomputers to act as file, printer, and communications servers for networks of PCs. Using such programs can eliminate

problems with massive storage needs and

communications gateways. ■ Remote station access. The ability to allow remote users to dial in through an RS-232 port on the server or on other network computers can effectively extend the reach of your network to stations far beyond the network cable. Though the effectiveness of this feature is often limited by the telephone line's speed, it can be important in certain applications. For instance, salespeople on the road might wish to call in to check mail or use data files on the network. Such systems as NetWare and VINES offer this valuable feature.

■ Hardware kev. Some operating systems, specifically NetWare and Banyan's VINES, require a special hardware key to operate. In NetWare, this key can take up a card slot. VINES adds it to the server's serial port.

■ Internal bridging, Internal bridging allows network managers to mix and match media and topology plans. NetWare, 3+Share, and VINES all have the ability to put more than one network interface card in a server. (This capability is standard in Novell and Banyan products and is an option in 3Com products.)

■ Special disk format. Operating systems that are not DOS-based sometimes require a special disk format, thereby making the drive unavailable to DOS. This requirement, which both VINES and NetWare impose, may be a consideration if you intend to use the machine acting as the server for other numoses.

■ Fault tolerance. If critical business, security, or safety operations run on a network, the operating system software can

Tapestry/8



Pictures speak louder than words Especially when you're talking about LANs

apestry® from Torus Systems is one of the most widely used LANs in large corporations and institutions in the U.S. and around the world. Why? Because it is powerful and easy to use. Tapestry uses icons (relutures) to seamlessly integrate the most advanced office facilities available on a LAN.

Introducing Tapestry/8, only \$795, ...

Tapestry/8 is Torus' new version of Tapestry for networks of 8 stations or less. It has all of the features of regular Tapestry (with upgrade-capability, of course), and at under \$100 per station it is perfect for the small company or department.

... and the Torus Ethernet Plus adapter, only \$395.



The Torus Ethernet Plus adapter is the networking hardware of choice for your Tapestry network. It's an Ethernet standard adapter with data throughput among the highest in the industry. Tapestry runs faster on this board than on any other, including IBM[®] and 3Com[®] - at a much lower price.

Together these products are the complete solution to your networking needs. Advanced electronic mail. File sharing. Printer sharing. The performance to run even data-intensive applications. And since Tapestry servers are not dedicated, all of your PCs are always available for productive use.

Most importantly, each person in your office can understand and use the network's resources. Easily. Simply. Because it's all done with pictures. So before you purchase a LAN designed for com-

puter experts, look into Tapestry/8 and the Torus Ethernet Plus adapter – powerful network products designed for the way an office really works. Tapestry. The fabric of office automation.

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A.—Indicates Editor's Choice — No Proces are central declasse of the completity of LAN pricing options
NA—Not applicable product does not have the feature Service 2 - Remote Service (\$456), and each reflected PC requires 3 - Remote PC (\$256)

■ LAN OPERATING SYSTEMS

help improve survivability. So-called fault-tolerant operating systems mirror the fault-tolerant operating systems mirror the severe on a duplicate resource. If the first drive or server fault, the mirror image takes over. Novell's comprehensive system fault tolerant (SFT) packages provide a wide varriety of options and seamless take-over by the mirror image resource. Univalent of the server recovery scheme, it tues a tape log server recovery scheme, it tues a tape log recognition of the data files.

 Server-based applications. In the typical PC-based network, application programs run on the workstations, and the servers run special programs dealing only with security and resource sharing. This arrangement is usually efficient, but sometimes performing certain disk-intensive tasks on the network file server is more efficient; these tasks include indexing a database or compiling program source code. Some modern operating systems, like NetWare, Version 2.1, and Univation's LifeNet, can run appropriate application tasks on the server. The software to use these capabilities is just emerging, but it could bring more efficient (and more complex) operation to installations using diskintensive applications.

Server software memory. The amount of RAM used by the server software is important if you try to use PCs as obth workstations and servers in peer-to-per networks. It's less critical in networks with dedicated servers, but even then you should know whether you need less than 40K RAM (as with Artisoff's LAMassife) or 2MB of RAM (as with WIMES, Version 2.10) to run the oceratine system.

2.10/10 run the operating system.
Disk caching, Disk caching attempts to improve performance by storing frequently requested data in RAM. With the exception of CBIS's Network-OS and EasyNet Systems? EasyNet, alt the operating systems we review here support disching. (See Connectivity Clinic in this issue for information on the effectiveness of this feature.)

■ Workstation memory. Some network operating systems, like PC LAN, use more than 100K RAM on each workstation for the redirection software. Some, like 10NET and LANtastic, require much less RAM. Others, like VINES and 3+5hare,

Espestry .	SONET	3+Share	TOPS	ViaNet Hetworking Operating System	VINES
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5	0	•	•	•	•
requires both Remote Access, ISBS, and Remote Network Link, ISBS)		ot	0	0	O (requires PC Dial-ln)
O NA	O N/A	0 • 2	O N/A	O O N/A	0 10 LANs and 1 wide-area netw
VA.	O N/A	0 80286 and 80386	O N/A	O N/A	0 80296 and 80386
60K	3 126K	8 512K	3 120K	2 140K •	11 2MB •
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320K	BOK	840K	70K	140K	9 256K
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can hide their workstation programs in special blocks of memory provided in optional cards. The importance of losing memory in the workstations relates to the kinds of programs you use. Some people might demand access to everything DOS allows, while others might never miss a few hundred kilobytes of RAM. The option of hiding most of the networking code in RAM away from that used by DOS could be important.

- CONFIG.SYS program loading and/or command-line loading. Some network operating systems load driver modules through the CONFIG.SYS program when the computer is booted. Those modules always take up RAM, even when the network is not in use. Other systems load everything from the command line, so no RAM is used when the operating system software is not loaded. And other systems, like CBIS's Network/OS and Western Digital's ViaNet, Networking Operating System, for example, can load from either the CONFIG.SYS or the DOS command line PC LAN on the other hand, loads from the AUTO.EXEC file.
- Network administration. Every successful network has someone who officially or unofficially becomes the system administrator. What kinds of tools does the system administrator have to see in order to control who is using the network and what the workload is? Reporting system usage by user is standard in minicomputer systems, but rare in LAN operating systems. Yet on a LAN with many stations, knowing who causes the heaviest workload can be important.
- Diagnostic utilities. Some network operating systems give the network supervisor certain utilities to find problems and to configure the server for optimum operation. These utilities include reports of bad packets and network errors, along with tools for the operation of disk cache programs. Corvus Systems' Omninet PC/NOS and EasyNet Systems' EasyNet. for example, report network errors but do
- not report bad packets. ■ Security, Security is usually provided through the use of passwords. The best systems have different levels of access giving users various privileges (including read, write, modify, create, and erase) Another form of security is the ability to

provide password protection to facilities such as a disk drive, subdirectories, or even files. With the exception of Omninet PC/NOS, all the systems we review here offer the ability to link passwords with network resources.

- Electronic mail. A good electronic mail system alone might justify your investment in a LAN. It should store and forward messages, allow for direct replies and forwarding, and give the status of messages. Quite a few systems we review here lack a store-and-forward mail system, including VINES, EasyNet, PC LAN, TOPS, LifeNet, and ViaNet; 3Com 3+Share has an optional e-mail system.
- Rude messaging. Networking software should have the ability to exchange short "rude" messages that pop up on the bottom of the screen. Such messages are valuable for coordinating network operations such as printer sharing or server maintenance. But the rude messages should not become a permanent part of any lines they overwrite on the screen. EasyNet, NetWare, and ViaNet lack a rudemessaging capability.
- Print spooling. When several LAN stations use a printer attached to a central server, the print jobs are saved in a special file called a spool. (Every system we reviewed, except for EasyNet, offers print spooling.) The print jobs then queue for printer access. Users should have a way to see the status of their jobs in the queue and to kill jobs sent there by mistake. The network administrator should be able to change the priorities of print jobs in the queue and assign specific priorities to cer-

THE FUTURE Interoperability is the key trend for the future of PC-based networks and their operating system software. Computers running under Apple's Finder, Xenix, UNIX, OS/2, DOS, and other operating systems such as DEC's VMS will all interact as peers on the network

The differences between minicomputers and LAN servers will continue to erode. Machines based on 80386 and 68020 processors will handle both jobs at the same time. AT&T and DEC have taken the lead in this area, and now it seems that practically every minicomputer manu-

facturer is offering "DOS support" that makes the mini a server. At the same time. companies like Novell and Univation are hosting parts of application programs on the network server to improve performance and reduce network overhead.

Another clear trend is improvement in the tools provided to the LAN manager in new operating systems. Many companies are offering improved reporting and ways to manage security, costs, administration, and operational control of networks, Microsoft is working with 3Com in preparing a new OS/2-based network operating system called LANManager. They are providing many performance features, but they are also critically interested in giving managers access to operational cost, perfor-

Essentially, the future of networking is greater cooperation among computers. Multiple solutions will be available to handle every task, but no one solution will suit every requirement.

mance, and maintenance information. Novell has provided a rich menu of statistical features and management tools in SFT NetWare 2.1, and Banyan has done the same in Version 3.0 of VINES.

OS/2 will have little direct impact but significant indirect impact. Remember, OS/2 is a multitasking but single-usernot multiuser-operating system, and network designers must add multiuser features to OS/2. Companies marketing programs that don't use DOS on their servers will want their servers to host some OS/2 applications, and a number of techniques are available to do so. The long-term impact of OS/2 (in 1989 and 1990) will most likely be the improved quality of application programs hosted under multiuser systems such as UNIX. This improvement



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will, in turn, increase the challenge of multiuser systems to server-based LANs in typical workgroup applications.

Tomorrow's "enterprise LAN" (a network serving an entire business group, organization, or enterprise) will have many servers running different operating systems. Smaller networks will make more flexible use of powerful 80386-based machines.

Essentially, the future of networking is greater cooperation among computers. Specialized machines will perform specific IrO-intensive tasks, and powerful machines will split their resources in many ways. Multiple solutions will be available to handle every task but, as is true today, no one solution will be perfect for everyrequirement.—Frank J. Derfler, Jr.

EasyNet

The EasyNet peer-to-peer local area network is a product of EasyNet Systems of Ontario, Canada. A combined hardware/software system that sells for about 5397 per node (for a ten-node system), EasyNet won't run with the network products of any other vendor.

EasyNet sells its product on price and simplicity. Curiously, it supplies the best system-analysis and memory-mapping utilities we've seen from any company. But unfortunately, we had significant problems with the system software that precluded us from running our benchmark less.

The EasyNet hardware uses simple telephone wire and RJ-11 jacks for interconnection. Telephone-type tap boxes allow a neat system installation with physical flexibility.

ATTRACTIVE CTILITIES. We wish Engyles Systems would market the utilities, which come as individual programs on the installation disk, separately from the software. The Memory utility features over a dozen policys, including displaying the memory locations used by different types of programs loaded in RAM, the softwares interrupts they call, and thisks among application files and data files. The Tasks utility shows the stack activity of presentors. Which the utilities are useful for locations. Which is a substitute of the locations. Which is a substitute of locations. Which is a substitute of locations. Which is substituted in the locations are locations. Which is a substitute of locations. It is a substitute of locations are locations of locations are locations o

programmers and system integrators, they're certainly not of any value to EasyNet's typical users.

SLOW AND FRACILE. We worked with LagaVG System for several mouth, the lags which time the software was obviously as state of flux. We had problems installing versions earlier than 1.51. And allowed the control of the

Worse, the networking software is fragile. Performing any of several network management actions on the server while it was under load caused the system to fail. We don't present completed benchmark tests for this system because of repeated

failures under heavy load.

We'll continue to work with EasyNet
Systems to review its product, but at this
time you'd be well advised to try one of the
faster, more-reliable alternatives available

at a reasonable price.

—Frank J. Derfler, Jr.





(416) 273-6410
List Price: EaryNet 116,
5795 per kit (two interface boards, two RJ-tt cables, and two twisted-part cables).

Requires: For workstation: 256K RAM, one floppy disk drive, DOS 3.1 or later. For server: HP 3000 minicomputer with MPE 4 or later and hard disk. In Short: A combined hardware/software

In Short A combined hardware software system, EasyNet offers exceptional systemrandysis and memory-mapping utilities. Its crapping speed, however, plus its tendency to fail under heavy workloads during testing currently render it an inadvisable choice. Not copy protected.

LANtastic Network Operating System

A company that names its network operating system LAMassic presumes a lot, but Artisoft's DOS-based system lives up to its name. LAMassic Network Operating System, Version 2.0, supplies the basics plus several features unique to DOS-based operating systems, including the ability to use up to four interface cards in a single machine. Costing about \$200 per node based on a ten-node system, it's relatively inexpensive.

Like PC Local Area Network Program, ViaNet, and versions of Tagestry, LANtasic uses NetBloS to interface with network interface cards. Artisoft markets the network hardware on which we tested LANtastic, but with the right version of Net-BloS, the software should run on any vendor's interface cards.

LAMastic is not derived from MS-Net, but it allows any station(s) on the network to assume the server role (as do almost all network operating systems based on MS-DOS). So any station can make drives or printers available to other stations.

LOW BAPACT ON RAM. LANtantic, and flexible. It makes the smallest impact on flexible. It makes the smallest impact on workstation RAM of any of the products we tested. The combination of NeBIOS and redirector evidence running on a LAN-ARIO and redirector evidence running on a LAN-ARIO and the redirector of the Raman Company of the Raman Ram

Admittedly, you do lose some processing speed when you use a machine as both a LANtastic server and a workstation, but in comparison with competing operating systems, you lose little RAM. As a result, peer-to-peer networking becomes much more practical.

LANiastic also offers some forms of security control that we haven't seen elsewhere. The list of access privileges you can assign to individual users includes read, write, create file, delete file, create directory, and execute. The "execute"



Benchmark Tests: LAN Operating Systems

These banchmark tests clearly show the speed differences between poerto-peer shared networking software end software using declared servers. Every system that uses a declared server is traiter than systems in which you can also other hand, the systems that offer peerpeer resource sharing are more flexible and economical since they don't require the expense of a declared machine. Results are not given for EasyNet as it was unclein polymen for EasyNet as it was unclein polymen these benchmark.

DEDICATED SERVER SYSTEMS While Advanced NetWard 286 flash best out Universion's Livers in the last setting gracuror of ythaking Cornections. Universion's Liversion's Liversio

platform.
It is interesting to note that when there is no load on the network, every dedicated severe system will give you performance that is equal to or better than the performance of an 8-MHz standelone IBM PC AT operating from its own internal hard disk. As soon as you rev up the network and start queuing up requests for hard disk and soft of the performance when the production of the performance will be produced to the produced the performance when the produced the performance when the produced the produced the performance when the produced the performance when the produced the performance when the produced the produced the performance when the performance when the performance when the produced the performance when the produced the performance when t

PEER-TO-PEER LANS When we tested peer-to-peer resource sharing networks, we did not run ally applications on two we did not run ally applications on two you do use the server station to run local speciations simultaneously, you can predict the effect on network froughput. The reason is that the speed departation of both the local applications and the network services results from a complex memory facilities.

To interpret the results of the benchmark tests presented here, pay close attention to the reported results when four stations (in addition to the station running the timed test) load the network. This gives you some indication of how well the software handles contention for disk access.

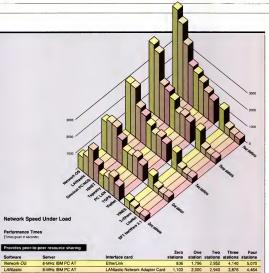
Of the peer-to-peer resource sharing LANs, Western Digital's ViaNet Networking Operating System was far and away the fastest. The interface drivers provided by SoftNet Communication for the system's KAL 1000 network interface cards are what helped speed the bits elong.

And even when a network turns out to be incredibly swift, remember that speed is just one factor you should consider when selecting a LAN operating system. For many applications, such factors as dealer support, training, end compatibility with other applications will be more important than throughThe Intervent's Speed Under Load and the Herd Disk Access Lead Berchman Isstem season by the ne needed to perform a standardized sea in the network. While the standard send season self-review be season (see Season Seaso

The Network Speed Under Load test puts a heavy load on the network interface (series), media, and are territy while placing a minimal load on the hard disk by heiving such attain continuously read and write its one 1-byte data file, changing the date each time. For systems with which cachine, the load on the hard disk is even smaller, since cached aystems typically perform a disk write but do not require a physical disk result.

The Hard Dlak Access Load test heavily loads the hard disk and disk-caching system. To do this, each station randomly accesses its own 100K data file using 1K records. Oats written to the file is changed each time. The rendom reads typically access data outside the narby which larges it disk send as done my write.

The Galabase Load feet exercises the systems accordioning support and the welly intended in uniform accordioning support and the welly intended in uniform anulatineous accesses to a common file. The Common file accesses to a common disables on contenting of an indice and data file. Nell'the accesses are simple searches of the rides file and in accompanyly access to a reaction the data file. Nell'the accesses are simple searches of the rides file and in accesses. The rides file accesses accessed the rides file accesses accessed the rides file and display accessed the rides file and display accesses accessed the rides file and display accesses accessed the rides file accesses accessed to access accesses accessed to access accesses accessed to access accessed to access accessed to access accessed to access accesses accessed to accesses accessed to access accesses accessed to access accessed to access accessed to access accesses accessed to access accesses accessed to access accessed to access accesses accessed to access access



Software	Server	Interface card	stations	station	stations	stations	stations
Network-OS	8-MHz IBM PC AT	EtherLink	836	1,796	2,952	4,140	5,070
LANtastic	8-MHz IBM PC AT	LANtastic Network Adapter Card	1,103	2,000	2,940	3,876	4,464
Omninet PC/NOS	8-MHz IBM PC AT	Corvus Omninet Transporter	1,766	1,974	1,986	2,178	3,432
10NET	8-MHz IBM PC AT	10NET Adapter Card	1,109	1,473	1,763	2,059	2,407
Tapestry	8-MHz IBM PC AT	Ethernet Plus Adapter	725	1,016	1,418	1,802	2,224
PC LAN	8-MHz IBM PC AT	IBM PC LAN Baseband Adapters	851	1,033	1,125	1,236	1,952
TOPS	8-MHz IBM PC AT	TOPS FlashCard	1,137	1,172	1,239	1.354	1,577
ViaNet	8-MHz IBM PC AT	SoftNet KAL1000/ViaNet	845	932	1,086	1,239	1,361
Requires dedicate	d server						
VINES	Banyan DTS DeskTop Server	EtherLink	479	812	1,067	1,225	1,320
3+Share	3+ Server Model 3S/400	EtherLink	360	342	354	388	454
LifeNet	Univation LifeServer 386	Univation Ethernet	223	238	256	291	340
SET MetWere 2 1	9 Mary IDM DC AT	Ethod jok	207	200	202	212	222

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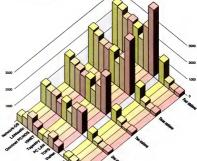
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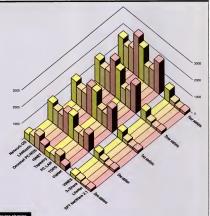




Hard Disk Access Load

Provides peer-to-peer resource sharing							
Software	Server	Interface card	Zero stations	One	Two	Three	Four
Network-OS	8-MHz IBM PC AT	EtherLink	406	1,127	1,686	2,157	2,482
LANtastic	8-MHz IBM PC AT	LANtastic Network Adapter Card	541	1,018	1,492	2,038	2,44
Omninet PC/NOS	8-MHz IBM PC AT	Corvus Omninet Transporter	826	1,016	1,402	1,752	2,129
10NET	8-MHz IBM PC AT	10NET Adapter Card	523	803	1,250	1,738	2,25
Tapestry	8-MHz IBM PC AT	Ethernet Plus Adapter	335	1,105	1,371	1,857	2,105
PC LAN	8-MHz IBM PC AT	IBM PC LAN Baseband Adapter	s 385	735	909	1,394	1,683
TOPS	8-MHz IBM PC AT	TOPS FlashCard	636	1,209	1,446	1,919	2,64
ViaNet	8-MHz IBM PC AT	SoftNet KAL1000/ViaNet	388	1,268	2,266	3,277	3,97
Requires dedicate	d server						

				-			
Requires dedicate	d server						
VINES	Banyan DTS DeskTop Server	EtherLink	218	504	721	960	1,331
3+Share	3+ Server Model 3S/400	EtherLink	182	203	258	309	336
LifeNet	Univation LifeServer 386	Univation Ethernet	108	117	125	139	173
SFT NetWare 2.1	8-MHz IBM PC AT	EtherLink	139	152	169	181	195



Database Load

Performance Times (Times given in seconds)

Provides peer-to-peer resource sharing							
Software	Server	Interface card	Zero	One	Two stations	Three	Four stationa
Network-OS	8-MHz IBM PC AT	EtherLink	406	1,147	1,297	1,403	1,574
LANtastic	8-MHz IBM PC AT	LANtastic Network Adapter Card	541	930	1,036	1,142	1,282
Omninet PC/NOS	8-MHz IBM PC AT	Corvus Omninet Transporter	826	894	1,042	1,208	1,474
10NET	8-MHz IBM PC AT	10NET Adapter Card	523	1,295	1,703	2,121	2,402
Tapestry	8-MHz IBM PC AT	Ethernet Plus Adapter	335	1,376	1,678	1,798	2,001
PCLAN	8-MHz IBM PC AT	IBM PC LAN Baseband Adapter	s 385	637	839	902	1,040
TOPS	8-MHz IBM PC AT	TOPS FlashCard	636	648	801	1,068	1,148
ViaNet	8-MHz IBM PC AT	SoftNet KAL1000/ViaNet	388	1,007	1,415	1,651	1,869
Requires dedicate	d server						
VINES	Banyan DTS DeskTop Server	EtherLink	218	422	520	612	722
3+Share	3+ Server Model 3S/400	EtherLink	162	202	221	227	234
LifeNet	Univation LifeServer 386	Univation Ethernet	108	116	117	121	121
OFT 11-441 04		May 11.1		400	400	450	400



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privilege is useful in situations in which users should be able to use, but not copy, software. It helps prevent copies of programs from walking out the door on floppy

Also, Artisoft advertises a \$149 hardware encryption option using the Digital Encryption Standard (DES) protocols. DES is a public encryption system soonsored by the U.S. Bureau of Standards and developed with the cooperation of the National Security Agency and the Department of Defense. DES encryption is "real" encryption, as opposed to the bit shifting or inversion some programs perform. Decryption occurs at each node, so gaining access to the cable does a potential snooper no good.

Another security and administration feature allows the system manager to specify that users log certain kinds of activities to a disk file, using a time stamp. This troubleshooting and security tool enables you to use the log to reveal any attempts at unauthorized access or other kinds of abuse

Although LANtastic lacks the kind of well-defined system for accounting for network use that Novell's NetWare offers, it keeps track of the number of network requests, the number of bytes read and written, and the size of printed files. A network administrator can extract this information

to project resource requirements and to allocate in-house costs for network use.

A strong selling point for network operating systems like Novell's NetWare and Banyan's VINES is their ability to host up to four different or identical network interface cards in the same server, allowing bridging within the server. You may wish to have several cards in a server to improve the reliability of a subnetwork, to allow the use of different media like fiber optics, or simply because you have cards someone already paid for that you want to use.

The LANtastic server module, however, is unique among peer-to-peer networks in that it lets you combine up to four network interface cards (each with its own manufacturer-provided NetBIOS) in a single node. This specification assumes the availability of well-behaved and complete implementations of NetBIOS from each board vendor, which is not always the case.

GOOD MENU SYSTEM While I have my reservations about using menus to link network resources. LANtastic does have a good menu system. Anyone using the menus to link resources still must know what server name to use and the network names of the resources, but at least the menu lists the network names once you enter the server name. Fortunately, the designers of LANtastic let you use NET USE in batch files (although with slightly different syntax than that used in MS-Net) to get

the job done invisibly. LANtastic includes a simple but effective electronic mail system and print spooling. If a program writes directly to INT 17h and does not open or close the LPT1 device, then, to spool the print job, you must either terminate the program or press

Ctrl-Alt-PrtSc (just as in PC LAN).

BOTTOM LINE The LANtastic starter kit (\$399) comes with all the hardware and software needed for two stations. A network installation license (for 3 to 120 nodes) retails for \$295. That means that a ten-node system, with all hardware and software and the provided 15-foot cables, costs \$2,285, or \$228 per station. Networking doesn't get much more economical than that.

In addition, the Artisoft designers dif-

ferentiated LANtastic from other DOSbased products in several useful wavsamong them, adding unique security and management reporting features and the ability to combine up to four interface cards in one node. And the small size of the program modules will attract those who don't want to add EMS to networked workstations acting as servers.

The low price and high capability of LANtastic's software, as well as its unique capabilities for DOS-based networking, make it a fine value. All things considered. LANtastic lives up to its name. -Frank J. Derfler, Jr.

LifeNet

LifeNet, a full-featured LAN system from Univation, breaks new ground in the technology of network operating systems. Selling for about \$249 per node (based on a ten-node system), it combines the advanced features of system fault tolerance with database service on a network.

Our previous review of LifeNet (PC Magazine, February 16, 1988, page 223) showed slow benchmark test performance, but our tests of the new version of LifeNet (Version 2.5) found significantly improved performance. In fact, it rivaled that of Novell's SFT NetWare on an 8-MHz IBM PC AT and Banyan Systems' VINES on a Banvan DTS DeskTop Server. When the folks from Univation loaded the newly released 386 LifeNet software, the performance of the system increased dra-

Univation offers LifeNet in versions that will work with hardware from other companies or with its own server and network interface hardware. We benchmarktested the LifeNet system using Univation's hardware, including the Univation LifeServer 386 file server and the Univation Ethernet network interface cards. LifeNet requires a dedicated server, and we recommend using Univation's 80386based server.

LifeNet 386 with the Version 2.5 features is sold on a single disk, and the utilities take up extra space. The operating system is ready to run on a Univation server. The software uses the 386 processor in its protected mode. Even with a plain-vanilla Western Digital disk drive controller in the



for two stations), \$399; network license for 3 to 120 nodes, \$295. Requires: 256K RAM in server and per node, DOS 3.1 or later.

In Short: A peer-to-peer operating sys featuring small size, unique security and management reporting, and the ability to use ar mixed/matched network interface

cards in a server. Low price and high capability. Not copy protected.



Coming from Lotus:

server, the benchmark test numbers flew by at a quick pace.

In either the 286 or the 386 version. Univation markets LifeNet as a "thirdgeneration" network. They list the generations of software as disk server, file server, and now database engine.

DATABASE SERVICE Database servers (or engines) process certain I/O-intensive DBMS requests on the central file server. To implement this process, you must break the DBMS activities into two parts. The major part of the application runs on the workstation. A core module of the DBMS runs on the database server, responding to requests from the workstation

application. The database server approach offers speed (fewer I/O actions and file transfers), improved efficiency (since files and records are locked for a shorter duration of time), and reduced chances of corrupting data because of data transfers. The drawback of the database server approach is its requirement of a special version of the DBMS software.

A version of the powerful DataFlex DBMS designed for LifeNet is now available. We saw a demonstration of a DBMS application using DataFlex that showed an improvement of better than 4-to-1 in performance using the DBMS server over typical LAN or local workstation operation

SOFTWARE FLEXIBILITY Installing software on the workstations requires DOS 2.0 or later. The menu-driven SETUP utility, which comes on a disk with each interface card, copies all the required system files and defines the DOS environment statements for the workstation.

Like NetWare and VINES, LifeNet allows several different network interface boards to interoperate in the same file server. Up to eight interface boards can reside in a server. Univation provides LifeNet drivers for network interface cards from Omninet, IBM (PC Network and Token-Ring), Sytek, and Standard Micro Systems (ARCnet).

Version 2.5 of LifeNet even allows anyone on the network to use LifeNet and Novell NerWare servers simultaneously on the same network. This means, for exam- user can send messages to any other user or



Life Net, Version 2.5 Univation 638 Gibraltur Ct. Milpitas, CA 95035 (408) 263-1200 List Price: Entry-level version for six users. \$695; Standard Lafe-Net/286 for up to 40 users, \$2,495, Advanced LifeNet/386 for up to 100 users, \$3,295. Products priced per server. LifeNet Accelerator software, \$595, supports extended mem-

Requires: For workstation: 65K RAM, one floppy disk drive. For server: 640K RAM, extended extended memory supported up to

SMR In Short: A fast, sound network operating system that's easy to install and use. LifeNer lacks the reporting and management tools of SFT NetWare, Version 2.1, and of Banyan's VINES. But it does come with some user utilities and is less expensive than its competitops; a legitimate alternative to Novell's. Banyan's, and 3Com's systems. Not conv. postected

ple, that you can redirect the F: drive of your workstation to a NetWare server and the G: drive to a LifeNet server using a single network interface card in the workstation. This type of flexibility is exceptional.

The system comes bundled with on-line pop-up help, a phone messaging system, and a calendaring system. LifeNet provides capabilities to remotely access the system through an RS-232C connection on

The on-line help is RAM-resident, but you can easily unload it to reclaim RAM space. Version 2.5's help screens are easy to read, and the menu system is flexible and operates clearly.

HANDY TOOLS The Tutorial Maker utility lets you create self-running tutorials for any application running under MS-DOS and LifeNet. It records and replays keystrokes and runs programs under its control. You can add comments to screens explaining what the users see.

The RAM-resident Phone Message system provides the basic mail system. A

to all users in the system. Each user is assigned a unique two-letter logical code as a mailbox address. Incoming messages are automatically stored in each user's private

LifeNet offers an alternative to the traditional pocket appointment book by providing an electronic pop-up appointment system called LifeCal. This primitive system lacks the meeting-scheduling capabilities of 10NET's calendar.

MANAGEMENT AND SECURITY Logging into LifeNet as the system admin-

istrator automatically brings up the System Manager Menu. This menu offers the ability to update the central system, create/modify each user's startup file, check network and file status, create/delete users, and perform system housecleaning.

The LifeNet Network Status gives a real-time visual status display of information about users, the print queue, and disk usage. LifeNet has utilities to display disk assignments, set and review file attributes. convert word processing files to LifeNet Help menu files, and display logical drive assignments. The system administrator can use these tools from any workstation. Although a few months ago LifeNet's utilities for LAN administrators were as good as any on the market, the release of SFT NetWare 2.1 has given the industry a new goal to shoot for.

LifeNet's security features are excellent, and the security process is both flexible and detailed. If you take the time, you can password-protect single files, hide directories from categories of users, and even protect access to the floppy disk drive on the server. The ability to assign users to groups with specific rights and privileges makes routine password and access right changes simple and easy.

FAULT-TOLERANT OPERATION Univation calls LifeNet "fault tolerant." Despite the fact that LifeNet makes it easier to recover from faults than most systems do, it does little to stay alive or gracefully shut down during failures. What it does is canture selected important activity and recreate it in a backup version.

The LifeNet System Log utility tracks each transaction to tape, making it easier to reconstruct files if you lose a disk drive.



When the administrator sets a file's log flag, the server's tape log archives any transaction written to the file. Files suitable for logging are those that many users access simultaneously, since it's difficult to know the best time to back them up. In the event of a system failure, you can use the tape to reconstruct the changes to the files. In certain cases, the tape log can help find the reason for a program crash.

LifeNet's improvements come primarily from a better disk-caching system and generally more-mature software than we saw in our first review of this product. Sequential reads from a file remain fast, but the new release of the software handles random-access reads more effectively. Interestingly. LifeNet doesn't show the aversion to small record sizes (512K) that is apparent in some other networking software. So it should do a good job handling requests for small records in a multi-user DBMS environment.

In sum. LifeNet is a sound network opcrating system that's easy to install and use. The 386 version of the software is very fast. The operating system lacks the reporting and management tools available in SFT NetWare, Version 2.1, and (to a lesser degree) in VINES, but it offers some user utilities.

LifeNet is less expensive than the systems it's positioned against, and Version 2.5 is a legitimate alternative to Novell's, Banyan's, and 3Com's network operating systems.-Frank J. Derfler, Jr.

Network-OS

The name of this product from CBIS says it all: Network-OS. A DOS-based operating system. Network-OS allows any PC on the network to contribute resources. You don't need to use a dedicated file or printer server.

Network-OS (\$128 per node based on a ten-node system without interface cards) is available in versions customized for many different types of network interface cards. Thirteen driver options include the latest Western Digital StarLAN and Ethernet cards, the 3Com EtherLink, ADC's clustered CPU system processor cards, the IBM Token-Ring Network, and Ungermann-Bass network interface cards. A ver-

the NetBIOS interface provided by IBM. Sytek, and many other LAN hardware

manufacturers Installing the software, which comprises two disks, involves running a network install program and copying the AUTOEXEC.BAT and CONFIG.SYS files to the root directory. It took us only about 10 minutes to install Network-OS. including formatting a disk for the boot disk, CONFIG.SYS requires no DEVICE statements to run Network-OS, but you must make sure that any machine acting as a server has enough buffers and file control blocks available

You call the network program from a single line entered at the DOS prompt or in a .BAT file. The benefit of initializing it this way is that you don't have to set aside the necessary RAM until you actually need to enter the network. (Networking programs installed as device drivers in the CONFIG.SYS file use RAM whether or

not you use the network.) We ran Network-OS on top of 3Com's EtherLink cards. The cards have a rated throughput of 10MB per second, but, as you know by now, the rated throughput of the network interface cards is practically meaningless. Network-OS proves this point better than most DOS-based systems. You gain nothing by installing "high-throughput" network interface cards if they have to wait for the hard disk

Network-OS's user interface features attractive menus, with several sentences to describe the options. You can also use the unique programming commands of Network-OS in batch files, so users can bypass the menus if they prefer.

drive to deliver data

The syntax of the programming commands is similar to that of commands used in packages derived from MS-Net, but the words are slightly different. NWUSE replaces NET USE, and NWSHARE is the same as NET SHARE. Typing NWSHARE alone brings up a display showing what the available resources are and who is using them.

The NBAS utility, which allows you to retrieve statistical data on network interface cards in network PCs, is handy for troubleshooting cable and card problems. The statistics include the amount of time sion is also available that works through the card has been active on the network



the number of packets sent and received. and the numbers of the different kinds of transmission errors. No other networking program in this class has such a utility.

Network-OS's network configuration program allows you to set the overall network configuration, set the resources the server will share, and use resources as various drives. You can also change the configuration of the program to set different levels of time slicing and interrupt polling.

The system's printer spooling is simple but effective. Pressing Shift-PrSc brings up a menu of printing options (including printing the screen to a local printer). From this menu, you can manually close the print spool without exiting the application program-a nice way of handling the problem of printing from an application. A timed closure of the print spool is also available.

The Network-OS Message system is designed for real-time transmission of messages to stations signed onto the network. Although it's not a true store-and-forward electronic mail system, it's useful for asking people to change the paper on a printer or make other resources available. You can use the message system either as a memory-resident pop-in utility (using Alt-Esc) or as a separate application program. A menu system for the intercom lets you specify individually addressed and network broadcast messages.

Like most network operating systems,



Coming from Lotus.

Network-OS needs a large block of RAM, to run. On a workstation (not sharing resources) with 640% RAM, DOS 5.3, the networking software, and the message system of the property of the first of the firs

502K Of RAM free.
Network-OS is an alternative to products like IBM's PC LAM. It's easy to install and use, but it isn't speedy, even when used on interface cards with high data-transmission speeds. On the plus side, its various versions can work with many different network interface cards.
—Frank J. Porffer. Jr.

Omninet PC/NOS

Omnine PC/NOS is a LAN Operating sysman processing the processing systems of the first own of the first own of the first own of the first own beautiful collar are network interface cards and servers as well as Omnine PC/NOS. The 579 operating system (eight-user version), which has a Omnine PC/NOS. The 579 operating system (eight-user version), which has an archicecture slightly different from the nat of most of the other MS-DOS-based network operating systems, offers a pere-to-peer network for sharing files and printers and for transmitting messages.

We tested Version 1.1 of Omninet PC/NOS, which comes on four disks. Mirroring the functions of the network nodes, the labels of the disks are server, shared workstation, workstation, and utility.

workstation, workstation, and utility.

A concept unique to Omnine Place of the Control of the C

The workstation software module, essentially only a redirector, makes the most RAM available for running local applicath most installations, administrators will

tions. When you select the workstation module, disk drives are not available for sharing

sching.
Unless you use a device like RYIS
Electronics' Hi-Card, which frees up
Electronics' Hi-Card, which frees up
much RAM forth to you applications on a
forth of the result of the result of the
May of the result of the result of the
RAM and tenning DAS 3.3, CHESSE
RAM free on a workstation loaded with
Free on a workstation loaded with
Free on a workstation loaded with
the shared disk mode, and 210 bytes free on a
server.

INSTALLATION To install the Omninet PC/NOS server software, you simply inser the installation disk in the A drive and type Install. The menu-driven system asks one simple questions, allows you to select options like print service, and prompts you to insert the required disks. The installation software creates the necessary subdirectory on the server's hard disk and modifies or creates a CONFIG.SYS with the necessary values for files and buffers.

The interface to PCINOS is a multilevel menu system called Net View, which gives users access to all printers, disk drives, and other resources on the network. Net View consists of a series of vertical pop-up "strip" menus that show the networked resources as well as the possible DOS device names on the PC, and is allows you to

PC/NOS also has a command-line language that lets you make the same kinds of DOS device name and resource links from DOS batch files. The commands and syntax don't follow the widely used MS-Net model, but they are relatively easy to use.

use NetView and set up batch files to link resources for individual users.

PLUGS AND SOCKETS Unlike other operating systems, PCINOS has two categories of connections. The first category is permanent links associated with a particular workstation. The second category includes so-called "temporary links" made only for a specific user. These commands are associated with a specific user log-on and are broken when a user logs off.

This setup gives users and the network administrator considerable flexibility. If your users frequently enter the network from different workstaions, you can make most of the links associated with user names. But if you want a stable and homogeneous network environment where every workstaion is configured the same, you can establish permanent links.

PRINTING, MESSAGING... Omninet PCINOS's print-spooling and messagesending capabilities are simple but effective. You can view a print cue and see where your jobs are, and you can link to a print spool either through menus or using command-line entries. The message capa-





rise Price Eight-user version, \$795. Unlimited (technically 100user) version, \$495 for first station; each additional computer requires workstation pack, \$295.

\$295.

Requires: For workstatum: 320K RAM, one disk drive, DOS 3.1 or later. For server: 384K RAM (\$12K RAM recommended), hard disk.

In Short: This LAN operating system for use tar Corvers language transcriptions (see, solid, peny-target).

to-peer file-sharing and network services. It includes two categories of disk-sharing nodes, each with different RAM requirements. System administrators will appreciate the detailed ments system and the security options. Not copy protected. CHICLE BM CONFELDING SERVICE CAND.

This chip is too smart to be in a personal computer.



Introducing the corporate 386.



The 386-based personal computers offer the individual raw power.

But, in most corporations, the real work is done by many people, all trying to work together. Computers should aid this process, by giving indi-

viduals the personal power they need, and by helping groups of people work together

productively.
Different groups
need to share and
work with the same
information, even
though they may be
using different computers, or their data
is kent on remote

mainframes.

In real-world corporate applications, PC users need access to a large variety of computing resources. So the Sun386i rains Sun's open distributed computing environment, built around the UNIX's operating system. Which lets it become part of a powerful open network that can include every computer in your company.

Personal 386s fall short of meeting these needs. Because they use underpowered and primitive operating systems.

So they can't handle the really demanding applications. And they only talk to themselves, with some difficulty, rather than to all of your computers.

That's why we're introducing the corporate 386. The Sun386i** workstation. It has the same high-performance Intel 80386 chip as the PCs.

But not their personal limitations. Because it runs Sun's open, distributed computing environment, built around the UNIX* operating system.

So, you have transparent access to every computer in your company. No matter which vendor's name is on the box.

Unlike the PCs, the Sun386i lets you take full advantage of the thousands of powerful applications designed around the UNIX operating system. But it also lets you run all of the PC

sophistication, isn't a Sun386i harder to use than a PC?

DOS applications that millions of users

And with its 5-MIPS power.

have developed so much expertise in.

run simultaneously and at full speed.

But with all this power and

UNIX and DOS applications can

Not at all. In fact, it's easier. Because we've given it a friendly, icon-oriented user interface with an integrated help facility. And a file organizer, to easily find, open, and keep track of files all over the network.

There's even an automated network administrator, that lets you personally install the Sun386i in minutes. Instead of hours.

So look to Sun for total networking solutions that help pull a company together.

If you'd like to know more, call 1-800-223-6736. In CA 1-800-322-6736. And we'll show you the difference between a personal machine.

And the right corporate choice.



The Network Is The Computer™

bility sends real-time messages to people who are on-line, but it has no store-andforward capability.

Omninet PCINOS uses a system of network names and passwords to establish security and user privileges. A user profile lists a well-defined series of privilege levels. Resources have corresponding security levels. If a user's privilege level is equal to or higher than the resource's security level, he is granted access to the network.

The system's designers recognized, however, that some installations don't need much security, so they created a group name called Maxaes. Anyone made a member of Maxaes has full user privileges—a handy way to adjust individual capabilities quickly.

BOTTOM LINE Since Omninet
PC/NOS is designed for the Corvus have
are, the pockage isn I a viable alternative
when you need a system that can operate
on a wide variety of hardware systems, as
IBM is PC LAN does. But used on the Constant and the Comminet PC/NOS offers
when the control of the Conference of the Constant and the Conference of the Conference of the Conference
you was a conference of the Con

PC Local Area Network Program

The IBM PC Local Area Network Program (or PC LAN) is one of the most sought-after network operating systems. Its popularity is due to its low cost, its relative case of use and installation, and its IBM logo.

The \$175-per-station (software only) PC LAN comprises, almost completely, Microsoft's MS-Net series of program modules. Since it lacks the program code needed to drive network interface cards, another layer of software must come between it and the network hardware.

When IBM and Sytek first married PC LMV's immediate predecessor, the PC Network Program, to Sytek's network interface cards, they dubbed the interface program NetBIOS. The original NetBIOS translated requests for service received from the networking software into direct commands to the network interface card hardware. Today, many vendors sumply a NetBIOS module for their network interface eards; you can use PC LAN on eards marketed by Sytek, Western Digital, Racore, Proteon, and many other vendors.

core, Proteon, and many other vendors.

As other vendors caught on to the use of
NetBUOS, IBM changed the name of its
latest version of the NetBUOS offware to
the Local Area Network Support Program
(LANSP, but some industry people invertently pronounce it as if it were LASP).

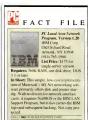
LANSP, which requires DUOS 33, includes
special drivers for the IBM Token-Ring
and PC Network II adapters.

COVERS THE BASICS PC LAN covers the basics: it allows any workstation on the network to make resources available to the network to make resources available to the network. When you make a drive, subdircotory, or printer available for sharing, you can assign passwords and associate thersource with a network name for security and simpler administration. Workstations with hard disk drives can spoot print job statistics active on the network.

Resource sharing and simple messaging are all you get. If you want to exchange electronic mail, dail in remotely, or see statistics on the use of the network, you will have to turn to third-party add-in soft-

FOUR CONFIGURATIONS Unlike its competitors, PC LAN offers four functional configurations, each of which adds another RAM-resident software module. The basic configuration, which includes only the Redirector, enables you to use resources on the network and to originate messages (one way) to other active stations. Adding the Receiver medule lets you see messages addressed to you, on the bottom line of your screen. The Messenger module asks you if you want to see the incoming message before it's displayed. The Server module allows you to make resources available to other network stations. The configuration you use depends on whether your computer has a fixed disk and on the amount of memory it has, as well as on the work you want to do.

RAM is particularly important. In a fully configured PC LAN system with the Server module installed, PC LAN uses 350K RAM. The LAN Support Program



can take 20 to 30K more (depending on the hardware used), and DOS and other programs use additional space. The PC LAV manual clearly libstrates a severe's RAM needs, but the added processing load is not a clearly described in the section on adjusting network performance. Using a computer as both a server and a workstation sounds like a good idea, but when you wide resources vou lose performance.

Installing PC LAN is easy, but if you not use IBM's TopView or a special non-English keyboard, you have to swap some files around first. The PC LNN Program Installation Add program creates a subdirectory for PC LNN and leads you through the process of modifying the CONFIG.SYS to add sufficient buffers and file control blocks.

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MENUS AND COMMANDS Versions 1.2 and later of PC LAV include menus hat take you through starting the networking software, sending messages, sharing and the same starting and the same discuss and directories, using resources, and considerable to the same starting the same starting to the same starting to

LAN manual.

PC LAN has about a dozen programming commands that you can enter from the command line or a batch file. The most frequently used commands are NET

PC LAN covers the basics: it allows any workstation on the network to make resources available to the network.

SHARE and NET USE. Many of the other commands. like NET PAUSE (which halts your computer's resource sharing so you can get some work done), are used infrequently. The commands use the Microsoft/BM syntax established in PC LM, which is a standard that other manufactur-

ers copy.

Like everything about PC LAW, the printer spooling system is solid and simple. You can see the status of printing jobs in any available queue, and you can create and use separator pages between printing jobs. Many poople were fustrated by the way the program always sent a form feed to print jobs, sometimes wasting preprinted forms, but IBM corrected that problem in the latest refeases.

NO SURPRISES PC LAN's performance times are typical of MS-DOS-based networks. In a DOS-based network, the operating software filters requests from the network and feeds them to DOS one at a time. DOS sees PC LAN as an application program and makes it share the pro-

cessor's attention with any other application that is running on the PC. This architecture simply cannot produce the same response time as the architecture of a dedicated server.

PC LAN is inexpensive, simple, and reliable. And it carries the IBM logo. In many situations, that's enough. —Frank J. Derfler, Jr.

SFT NetWare 2.1

Novell's major product is a robust, feature-filled LAN operating system called NetWare. We reviewed the newest version, SFT NetWare, Version 2.1, which retails at \$469 per node (based on a tennode system, not including hardware).

Like its major competitors, Banyan and Scom, Novell is evolving—from being a vendor of network operating systems only a conduction of network operating systems only a range of connectivity products. Novell of fers links to Macintosh computers, TCPIIP products to interact with the world outside microcomputers, and X.25 interfaces to connect to not only U.S.-solde networks connect to make the content of the co

VARIATIONS ON NETWARE Novell rehosts and reconfigures NetWare for a variety of applications. Versions are available to support the Motorola 68000 and the Intel 8088 series of processors. Novell's Advanced NetWare/286 uses the Intel 80286 processor in its protected mode and gains significant processing efficiency and memory-addressing capability. Some network companies market OEM releases of NetWare with their own hardware. One version of NetWare, the Entry Level System, is a low-cost way to network a limited number of workstations. It also allows the server to act as a workstation for some applications

An important variant of NetWare!286 is embodied in SFT NetWare. The SFT (system fault tolerant) concept involves mirror-image operation of one or more failureprone parts of the server and disk system. SFT NetWare, Version 2.1, offers two levels of fault tolerance tailored to specific needs and budgets.

The simplest version of SFT operation makes redundant copies of file allocation tables and directory entries. The copies provide backups in case the oxide coating of a hard disk is damaged in the area containing critical file directory information.

A more sophisticated SFT function allows two disk drives to mirror each other in different ways as a backup in case of drive or controller failure. The software also performs transaction tracking that prevents file damage if power is lost at critical times and creates an audit trail that permits you to reconstruct data from archive files.

The SFT features are important in any network application in which the data is critical to the organization's operations and profit-taking ability.

ARCHITECTURE All versions of NetWare, except the Entry Level System, have the same basic modes of operation. One dedicated machine acts as a server for all file-sharing and printer-sharing functions; workstations cannot share resources with other stations on the network. While you can easily establish networks that have many servers, you'll need to install a separate copy of NetWare, protected by a keycard in the server's bus, for each one.





Version 2.1 Novell Inc. P O. Box 5900 Provo, UT 84601 (801) 379-7808 List Price: \$4,695 for

List Price: 54,695 for ten-node system. Requires: 80286- or 80386-based server 512K RAM in the server (more recommendod) and 192K RAM in each workstation DOS 2.0 or later

NetWare Into of products—a fast, full-featured LAN operating system—includes management tools typical of minicomputer operating systems, but rare in networking software. This powerful yet flexible software a system is easy to use at a superficial level yet a challenge to master, but copy protected. CINCL BROWNERSEMSEMSC LAND

In Short: Novell's Version 2.1 of the

PC-PLUS High Performance Network Solutions

Unlike traditional LANs, PC-PLUS' on-the-bus architecture puts the computing power where you need it

— with the data — inside the server.

PC-PLUS: The LAN Engineered for Shared Data

Any local area network can connect PCs, PC-PLUS, however, is engineered to optimize multiuser access to shared databases. We put a PC - or AT - on a card that plugs into the server. Putting your computing power on the same bus as your data. Giving you high bandwidth where you need it. Without the transmission overhead that steals performance on most LANs.



PC-PLUS Gives You the Power You Need

Our plug-in cards come as 8 MHz PCs or 8 MHz ATs - to match your computing needs exactly. And PC-PLUS networks can deliver that power - proven by benchmarks. Power to get your job done. Power to grow into new applications without sacrificing performance.

PC-PLUS is Easy to Install and Use

We put the computing engines all in one place - in the server. Not spread all over the building. And our NTNX™ LAN software is truly easy to install. Use PC-PLUS with your choice of AT compatible servers or with Personal System/2.TM Add a card and terminal to grow, Simple RS-232 twisted-pair data cables - no expensive rewiring with coax.

PC-PLUS Runs With Personal System/2

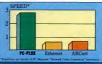
With Alloy's HI/2™ Micro Channel™ interface, you can connect PC-PLUS to IBM's Personal System/2 Model 50, 60 or 80. Use Alloy's expansion boxes to build PC-PLUS networks with PS/2 file servers. Or choose our PLUS4/PS for a simple, preconfigured 4 workstation network.



PC-PLUS: Find Out Before You Invest

A local area network is a long term investment. Today's applications are just the beginning. Make sure your choice is ready for tomorrow - with mainframe connections, remote access. graphics and the power for grow-ing database applications. Plus nationwide third party installation, on-site service and extended warranty plans available from the Harris Corporation.

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SCREEN SAMPLINGS

Some interesting and unique ideas in network operating system software.



This EasyNet menu describes the virtual disk drives and othe shared resources assigned to a specific station.



Seter-Selects as entry to modify. 7-For hel

LANtastic has a colorful and useful menu system. This particular menu shows the configuration of the server software.



SFT NetWare 2.1 contains many features usually taken for granted in minicomputer operating systems, but rure in LAN operating systems. The screen above shows cost accounting options. This feature lets the network administrator track and price LAN activity according to data blocks read and written, connection time, disk storage, and requests for network services.

The NetWare installation process reforms the hard disk drive of this server. While the server can contain a DOS partition, you cannot access the NetWare partitions on any server drives through DOS. You can access NetWare files only through the network. As a result, someone gaining physical access to the NetWare server cannot change, copy, or destroy the files on the server.

Workstations running under NetWare

load a program called the network shell, which is Novel's version of Microsoft's redirector. The loading process in SFT NetWare, Version 2.1, brings in the IPX communications driver software (see the glossary in "Networking Acronyms and Buzzwords") spearately from the shell. In prior versions, the communications driver was part of the shell. This is a clear indication than Novell's developers are planning to accommodate separate communications.

protocols in the future.

Excellent menus describe the system and its resources for Novell users. But as these menus typically describe available assets in terms of server names, volumes, and other network-unique references, the NetWare menu system is clearly not designed for novice users.

NetWare also includes a menu utility that lets the network administrator create menus that provide access to files, shared



With this special Network-OS display, you can use NetBIOS commands to request the status of the network adapter card in a workstation across the network. This display shows the configuration of this particular station and how busy it has been. In the hands of a technically inclined network administrator, this can

be a pawerful network management tool.

The latest version of 3Com's 3+Share networking software includes menus that help you move files and access files on network servers. In this example, a user has moved into a subdirectory of the D: drive and is tagging files for transfer.



PC Local Area Network Program offers a menu selection that makes it easy to share resources—here disks and directories—a redirect outputs to shared resources such as printers or modems.



ViaNet's menu system is simple, yet effective. This system management menu leads to other levels of detail.

printers, and other resources, though you could also use DOS batch files to perform the same function. Other utilities included in the system are printer spooling, automatic log-in scripts, and electronic mail. The printer spooling gives excellent control over print jobs. The presence of automated log-in scripts on the server reduces the administrator's need to maintain AU-TOEXEC.BAT files on every workstation. The mail system is comprehensive

and includes features like the ability to attach binary files to messages.

A high point of the operating system (shared to varying degrees by other network operating systems) is that it allows you to bridge various types of network interface cards inside the server. Consequently, you can hook various networks using different kinds of cabling into the same server or extend those with distance limitations by putting up to four network

interface cards in the same server. All of the stations can then talk to each other over the network. Novell provides software drivers for more than 30 different network interface cards, as well as software that emulates the NetBIOS communications functions between workstations.

THE NEWEST NETWARE Novell's real news for followers of LAN operating systems is SFT NetWare, Version 2.1.



To create the world's first data cartridge tape, our engineers had to give up a lot of dreams.

To bring the world its first data cartridge tape, it wasn't unusual for our engineers to put in a little overtime on their overtime. Or occasionally miss the late show. Or even miss a tonight, period. And even after the data cartridge

tape was born, they still refused to lay low. It had to be perfected.

So, instead of counting sheep, our engineers counted patents. In fact, over ten of them are in use today. A number no other data cartridge tape manufacturer



can even come close to matching.

During other sleepless nights, they'd toss and turn over technological breakthroughs like proprietary Blackwatch™ backcoating, No End Play (NEP) hub designs, Dura-Stat™ drive rollers and one piece tape guides for precision tracking.

The result was the ultimate data cartridge tape.

And to this day, it's number one in the world by a long shot.

So, if you're looking for data cartridges and

diskettes that offer durability, longevity and superior error performance, try one of ours. We guarantee they'll work as hard as our engineers do. Day. And night.

For more information, call 800-888-1889, Ext. 30.

Supporting the dream.

Version 2.1 supersedes Version 2.0a, but the difference to LAN administrators is much more than just a tenth of a version. Version 2.1 gives SFT NetWare features usually taken for granted in minicomputer operating systems but rare in LAN operat-

ing system.

SFT NetWer 2.1 has the tools PC network managers need to help reduce costs. It enables the network administrator to determine who uses the network (by user mane or by station) and then to assign costs back to specific individuals, departments, back in opening are compiled according to time connected according to time connected according to time connected according to time connected according to the connected according feature is both overdue and welcome in PC-based local area networks.

PC-based local area networks.

Other management features added in SFT NetWare 2.1 enhance the security of the system. You can place time locks—of maximum duration for the network user, the time of day, even the date—on the activities of certain stations or processes. You can also force periodic password changes and encrypt passwords with non-reversible encryotion algorithm-reversible encryotion algorithm-

Additional new operational features include providing users with access to all printers on the network, regardless of which server they are assigned to, and indexed file allocation tables. Indexed Turbo FAT enable you to search file allocation tables on large files (10MB and larger) quickly.

Novell is also giving third-party vendors more opportunities to make their products a part of the network operating system. Nearly a year before the release of Version 2.1, Novell published the specifications for a new series of application program interfaces.

One irritation in using earlier versions On/eWare is that relatively few makers of add-on hardware products, like disk and on the disk and the products into MerWare. Even an add-on storage device acquired and marketed by Novell, BatRAM from Santa Clara Systems, could not function on a screer trunting under Advanced Netsant Clara Systems, could not function on a screer trunting under Advanced Netsant Clara Systems, could not function on a screer trunting under Advanced Netcolor for the product of the country of the of the disk of the country of the product of the country of the product of the country of the product of product product

SFT NetWare 2.1 deals with that compatibility problem through a feature called value-added drivers (VADs.). The VAD specification gives developers a standard way to add their drives and other products to NetWare servers. Typically, the softhave they use to do so is simply another file on the installation disk that comes with the device.

VAPS AS WELL AS VADS Another important application program interface published by Novell for Version 2.1 is for value-added processes (VAPs). VAPs allow

NetWare users will find that Version 2.1 boasts more of everything: more disks, more menus, and more options.

•

programmers to run applications on the server in 80286-protected and real-time modes.

The most familiar VAP is probably database service. Novell makes designing the database server module easier by issuing standard VAP specifications. Though no VAPs were available at the time this article was prepared, future VAPs are expected to range from compilers to expert systems and will enable network users to change network applications and the way networks handle them.

Experienced users of NetWare will find that Version 2.1 boasts more of everything: more disks, more menus, more options. Also, it takes up more RAM space in each workstation. It's faster, too. Yet all programs and batch files from Version 2.0 will also work fine under 2.1.

Installing SFT NetWare 2.1 is nothing stalling SFT NetWare 2.1 is nothing shaffle through 33 floppy disks—some of which must be inserted many times. Tiers of menus present you with numerous options, and you'll find plenty of drivers (like to one for BaRAM). The new process makes you long for the familiar Version. 20 linking process—the very same one

that we used to consider so complex.

The NetWare station shell has grown to take up more RAM space on every work-station. With the addition of the IPX protocol drivers, the combination of DOS 3.3, IPX, and NetWare takes about 110K RAM on a workstation. Still, that requirement is modest when compared with what some of

NetWare's competitors require.

The menu called FCONSOLE gives the network administrator access to the new statistical reports. Various options adjust these report screens to change their sampling rate and to clear old data.

THE NOVELL FUTURE Novell responded to the introduction of OS2 and the rising popularity of the Macintosh Finder operating system and of UNIX by opening the NetWar architecture to allow interconnection with these systems. The company's response to a world of multiple operating systems is on two levels; gateways and transparent connections.

A LAN gateway uses one machine on the network as portal to other resources. The most typical gateway is to a large mini or mainframe computer. Today, most of these gateways let stations on the network of the properties of the pr

Tymnet or Telenet.
Novell is increasing the ways that it provides so-called transparent connections service between dissimilar systems. Transparent services allow an inexperienced user to access any resources in a multivendor network without knowing.

where they reside.

**NetWare has always been able to link
different kinds of network interface cards
in what is termed an internal bridge. This
capability increases in importance every
time IBM cements in the Token-Ring Network as a method of connecting to its
mainframes. Even if your network uses
ARCnet or StarLAN, the server is capable
of internally bridging a Token-Ring card to
IBM 9370 or any similar system that is

Share your peripherals and save.

How many expensive laser printers, plotters. modems and other peripherals are sitting idle right now? How many idle people are staring at their PCs, waiting for printouts?

To end this waste, all it takes is a little box. that lets your computers share every printer, plotter and modern. The Buffalo SX. At only \$648, it's about \$65 a port and less than a third the price of an extra laser printer you won't need.

An end to laser envy. The Buffalo SX is an intelligent buffer

switcher and interface converter all in one. Any user can select a peripheral, send a job into the big buffer (256K, expandable to 1Mb), and go back to work. No manual switching, no moving cables, no waiting, no jealousy over who's hooked up to the laser and who's not. can call on our nickel, too.

All the right connections.

The Buffalo SX has ten ports - five senal

three peripherals. Or connect two computers to eight peripherals. Or any combination between. You can even connect a parallel printer up to 400 ft. away with no additional

line drivers or boosters. Or start with two users sharing two printers through the Buffalo XL Add users two at a time with the non-buffered AS-31. Buffalo boxes combine to connect any number of PCs and peripherals. Now or

as you expand.

& automatic transm Your Buffalo SX comes with installation software and concise instructions that tell you how to install it. Or we'll tell you on our toll-free support line. Your users get simple on-screen menus, with printer names you assign. If they have a question, they

\$100 worth of software, Free,

With your Buffalo SX, we'll include three terrific productivity programs: 1. HyperKey™ for precise cursor control. Ends repeat key run-on. 2. HyperDrive** Disk Caching. Makes most applications run 3-5 times as fast: fully utilizes EMS or extended memory. 3. Print Booster* for 1-2-3* frees your PC four times faster when printing graphs. Call to order your Buffalo SX. If you can part with it, return it within 45 days and we'll

refund your \$648 Call now, Use American Express, Visa or MasterCard You'll save hours of frustration. not to mention the cost of another laser. Buffalo Products, 859 Cowan Road, Burlingame, CA 94010. Tel. 415-697-6249.

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> > riiftai n



equipped with a Token-Ring.

The NetWork Message Handling System allows appore to sord messages to a wide variety of remote networks without knowing where the recipient is located or how to route messages. A joint development between Novell and Soft-Settich gives the PC Mail system the ability to access host-based mail systems like IBM's PROFS and DISOSS, DEC All-In-One and VMSmail, Wang Mailway and Office, and MCI Mail. The Soft-Switch Minhridge Server interfaces with The Colost-based mail service through a gateway or direct connection.

Novell promises future development of a Universal Network Architecture (UNA). UNA conceptually allows for vendor-specific interfaces like IBM's APPC and DECnet functioning as value-added processes.

MAKING ROOM FOR OS/2 Since OS/2 is still evolving, Novell's methods of accommodating it are also still evolving. In the first quarter of 1988, Novell introduced the NetWare Requester. This OS/2 module extends the services of OS/2 across the network to the NetWare server. The NetWare Requester runs in network workstations along with the Standard Edition of OS/2. Developed by Novell with assistance from IBM, it allows workstations equipped with OS/2 Standard Edition to coexist on a NetWare LAN with DOS workstations, provides access to all NetWare services, and allows users to run both DOS and OS/2 applications.

The Novell NetWere Coprocessor, scheduled for delivery following the release of IBM's Extended Edition of OSV-detraction of the Coprocessor of the Coprocessor of the Coprolet NetWere support for OSV-server-based applications on the file server. NetWere support for OSV-server-based applications not the file server. NetWere support of the Coprocessor runs NetWere value-added processes. The coprocessor will be available for both the standard IBM FC AT but and the IBM FCS Metro Channel architecture.

BOTTOM LINE Another consideration when evaluating NetWare is support. Novell maintains a chain of NetWare Centers providing local training and technical support. 3Com, Banyan, and IBM do these same jobs in similar ways, but Novell has the most concentrated field support program.

Overall, NetWare sets the standard for a robust and complete LAN operating system. Any job that you can do reasonably well on a PC-based network, you can do using Novell's NetWare: it's mature, flexible, powerful, and first. Like any powerful tool, NetWare can be a handful to master, but it's also rich in tools and alternatives.—Frank J. Derfler, J.

Tapestry

Tapetary, a local area network operating as system marketed by Torus System for System is sold in the eight-user version for SP9s, is one of the most complete DOS-based LAN operating systems. Although Torus markets Tapetary in several form; in several form package sold most frequently is Tapetartry/8, an eight-user version of the sold participation of the property of the complete participation of the property of the property or any other LAN hardware that comes with a NetBIOS interface, including hardware from IBM and many other vendure.

Tapestry features an icon-based interface, a feature-rich electronic mail service, and extensive printer-sharing utilities. It also play—that the best networks in visible and that an administrator should use DOS techniques to hide the network from the users—on its head. Instead, Tapestry uses the network to hide DOS.

In the Tapestry system, icons represent applications and tools. Because of Tapesapplications after a polication like a database (where multiple users read and write files) must operate through the selection of an icon. The user has little opportunity to interact with DOS, although the administrator can build icons that activate batch files.

Tapestry is one of the few DOS-based LAN operating systems that you can use either over network interface cards running NetBIOS or through the special software drivers that Torus supplies for some cards. The NetBIOS compatibility of Tapserty is related to IBM's marketing of the product in Europe as a graphic alternative to IBM's PCLLM. TEDIOUS TO INSTALL Tapestry is one of the most-complete DOS-based operating systems in terms of added features, but it is also one of the most-tedious programs to install. The operating system needs to know the specific address of every interface card used in the network. Since this address is burned into a ROM on the cards and not noted externally, you must first run a special program on every PC to get the address of every card. Then, you must enter each 17-character address into a relatively complex menu. You must establish and keep an exact correlation between a menu of users and a menu of node names and identifiers.

Each copy of the software becomes linked to the interface board on which it is installed. Therefore moving equipment and swapping interface cards requires more than the normal amount of attention to details—like which copy of the software goes with which interface board.

Once you've installed the software, you have to set it up. Because of *Tapestry*'s unique architecture, the setup process is not intuitive. We spent long hours staring at icons and the manual, trying to under-



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NETWORKING'S NECESSARY HARDWARE

LANs do not live by software alone. You also need servers, workstations, cards, and cables to fashion a complete system.

Servers, workstations, cards, and cables are the dry-bones hardware into which networking and application software breathe life. Though this issue emphasizes software, you need to understand how to put the software together with the hardware to come up with a complete system.

SERVERS AND CLIENTS In a PCbased network, computers act in the functional roles of servers and workstations (sometimes called "clients" to differentiate them from high-powered graphics "workstations").

gagata: Workstations); Ambet their attached disk drives, printers, moderns, and other resources available to the workstations. Some acceptance of the control of the contr

You can use an 80286- or 80386based machine as a server. Many networking companies also sell heavyduty AT-class machines with the power supply and eabinet capacity to support several disk and tape drives as dedicated servers. Companies such as Novel1, 3Com, and Univation increasingly feature dedicated servers with 80386 pro-



A local area network typically combines networking spirare (like Univarious' is LieNet, shown above) with network interface cards, a peech hard-dike equipped compare acting as a server, and calding to it the pieces together, as more manifectures have network interface cards has dropped from around \$500 to 500 occ down to the \$200-to-\$400 range. Serveral atternative types of cabling, including fiberopite, institude pair wire, and coaxial cable, are mailable as well.

cessors. Banyan sells servers that use processors in the Motorola 68000 family. These dedicated servers usually cost from \$6,000 to \$10,000.

INTERACE CARDS Inside each workstation and server, a network interface card communicates with the networking software through either BIOS or special driver software. The size and on-board processing power that the network interface cards vary greatly. Ventors such as 20m and Protoco and control of the processing power than the network interface cards vary greatly, ventors such as 20m and Protoco and cards, typically used in servers, that carry their own 80186 processing and RAM to keep network-communication tasks from bardening their bost systems.

Companies such as National Semionductor, Texas Instruments, and Standard Microsystems market chip sets for Ethernet, Token-Ring, and ARCnet network interface cards. While 18 months ago a typical network interface costs 5000, the increased availability of those chip sets has turned interface cards into commodity products—with current prices for "no frills" Ethernet and ARCnet cards ranging in the low 5200.

Some networking software, such as 10NET, runs only on proprietary network interface cards. But many other products will support cards from a variety of vendors.

CONNECTING CABLES It's the network interface card that determines the type of cabling you'll need to connect the servers and workstations. Choices include twisted-pair telephone wire, shielded twisted-pair data-grade wire, coaxial cable, and fiber-optic cable.

stand the process. While we're not making a direct indictment of *Tapestry*'s operation or structure, we found its installation and setup slightly confusing, somewhat tedious, and definitely more complex than those of its competitors.

EASIER IN OPERATION The good news is that once the administrator's initial work is done, the users have things easy, within a limited world of alternatives. All the resources of the network are available through point-and-shoot icons. You typically pass from a *Tapestry* menu to the opening screen of the application with no intermediate stops. Terminating a program brings you right back to *Tapestry*.

Tapestry's icons use the office analogy.

Disk drives are divided into filing cabinets and drawers. You "open" cabinets and

drawers by tagging them from a menu in the bottom half of the screen. Not only can you click a mouse on the icons, but the program even gives you the up-and-down "elevator" boxes next to windows of file listings.

You use Tapestry's tools for every
DOS function, from formatting disks to
making file transfers and viewing text
d files. A full-screen editor lets you build

However, if one of these types of wire is already installed in your building, you'll want to select an interface card that can work with the existing wiring.

Twisted-pair telephone wire is typically installed in buildings to carry voice Private Branch Exchange (PBX) telephone traffic. Many companies see this wire as an excellent way to carry data too. You're likely to find sufficient twisted-pair wiring for your LAN if your building was wired for a PBX within the last 6 to 7 years. It should come as no surprise that AT&T's StarLAN system was one of the first to use twisted-pair telephone wire for LANs. But you can now get Ethernet (3Com) and ARCnet (Standard Microsystems) interface cards for unshielded twisted-pair wiring. IBM's PC LAN Baseband Adapters use two

pairs of twisted wire to carry data signals. When you find them installed, twisted-pair telephone wires have the significant advantage of economy. However, because the wires can absorb noise from radio and electrical devices, the network interface cards will have difficulty communicating in environments that have a great deal of electrical noise.

Data-grade twisted-pair wire, on the other hand, carries an external aluminum-foil or woven-copper shield that is specifically designed to reduce electrical noise absorption. Different companies have their own specifications for these cables, although IEEE standards apply to

systems like IBM's Token-Ring.

Shielded twisted-pair cables are expensive and difficult to work with and require custom installation. Still. IBM has been successful in marketing a wiring plan that uses these cables for Token-Ring installations. The IBM plan adds reliability (and substantial cost) by using a separate run of cable between every server or workstation and a central wiring hub. This wiring plan significantly increases the amount of cable used, but it also ensures against total failure of the network in the event that one cable is broken or shorted.

Coaxial cable, particularly the thin RG-59 or RG-62 type, is easier to install than shielded twisted-pair data-grade cable and has many of the same noise-resistance advantages. This cable is used in Standard Microsystems' ARCnet and 3Com's EtherLink. ARCnet typically uses a hub wiring plan in which every station links directly into a central wiring hub, a scheme that reduces the vulnerability of the overall network. EtherLink, on the other hand, uses a station-to-station wiring scheme that is economical because it uses less cable than a hub-type scheme but that runs the risk of total network failure if any one link is severed or shorted.

Though it does not improve transmission speed, fiber-optic cable allows for greater distance between stations and provides total immunity to electrical noise. A fiber-optic link can run for several kilometers without the need for repeaters to regenerate the signal. Radio transmitters, arc welders, and noisy fluorescent lights have no effect on the light pulses traveling inside such cable. Many vendors, including Proteon, Pure Data, and IONET, offer versions of their network interface cards adapted to fiber-optic transmission. Codenoll Corp. specializes in fiber-optic devices-such as hubs, amplifiers, and bridges-and has fiber versions of Ethernet and ARCnet cards.

If you install the cabling from scratch in an existing building, it can account for the most-significant costs of the network. Depending on local labor rates and building codes, installing cable can cost as much as \$1,000 per workstation. But as the results from the PC Magazine Interactive Reader Service's survey indicate, many companies are installing the cable themselves-even if they have systems integrators install the networking cards and software. Using existing telephone wiring is another cost-reducing practice.

CONSTRUCTING THE WHOLE Because of currently available de facto standards and protocols, you can mix and match these pieces-servers, network interface cards, cables, and software-in myriads of ways to form an optimally productive and cost-effective network. -Frank J. Derfler, Jr.

batch files or write notes without fancy formatting into ASCII files.

All of this insulation from DOS brings its own set of adjustments and complexities. Some actions, like changing the active disk drive, are more complex in Tapestry than in DOS.

The default is to set Passwords for the use of practically every service. But there group associations to make security activities easier for the administrator. Security in Tapestry means that users and the administrator must keep track of lists of passwords.

Tapestry has five levels of read/write protection for files. These levels of privileges offer separate capabilities for the owner of the file and for other network us-

share it with others through the network. you have to execute a complex series of actions to select the file and unlock it so that others can modify it.

PLUSES AND MINUSES To its credit, Tapestry's performance was better than that of many of the other DOS-based products compared in our benchmark tests. We are no handy tools like network names or | ers. If you want to create a file and then | ran the program on Western Digital Ether-

Smarter by Design.









CPU 386/20 Monitor Not Included CPU 386/16

CPU 286/P Includes LCD Display

	CPU 386/20	CPU 386/16	CPU 286/P
Standard Features			
CPU	86386-20	80386-16	80286-12
Clock Speed (MHz)	8/16, 10/20	8/16	6, 8/12
Walt State	Zero	Zero	Zero, Norton V3 SI rating: 15.3
RAM	IMB static column	1MB static column	612K DRAM (89ns)
On Board Expansion Memory	Up to 4MB	Ep to 4MB	Up to 4MB
System Expansion Memory	Up to 12MB	Up to 12MB	Up to 16MB
Math Co-Processor Support	86/287 / 90387	86257/86387	80287
Controller Card Handles	2 hard disks, 2 floppies	2 hard disks, 2 floppies	1 bard disk, I floppy
Disk Drive(s) Included	1.2MB floppy drive	1.2MB floppy drive	20MB hard drive, 1.44MB floppy driv
Clock/Calendar	Yes	Tes	Yes, with 10 year battery life
Ports	2 serial, I parallel, joystick adapter	2 serial, 1 parallel, Joystick adapter	2 serial, 1 parallel, joystick adapter
Expansion Slots	1 32-bit memory bus, 6 16-bit, 2 8-bit	1 32-bit memory bus, 5 16-bit, 2 8-bit	3 16 bit, 2 8-bit
Keyboard	101-key enhanced	101-key enhanced	86-key
Power Supply (watts)	200	200	200
Reset Switch	Yes	Yes	Yes, with 2-second safety delay
B10S	Award 32-bit BOM	Award 32-bit BOM	Phoenix
Warranty	1 year	1 year	1 year
System Configurations			
Monochrome System w/Hard Drive	\$2,786 \$3,130 (403/B)	\$2,635 \$2,430 (40MB)	n/a \$1,796 (26MB)
EGA System w/Hard Drive	\$3,185 \$3,580 (40MB)	\$2,485 \$2,880 (40MB)	n/a n/a
Special Note	Also available as CPU 386/20 Tower (optional). Made in U.S.A.	Also available as CPU 886/16 Tower (optional). Made in U.S.A.	22-pound portable includes 26MB hard drive and Supertwist EL back! LCD. Made in U.S.A.

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Better By Desire.







CPU 286/12

CPU 286/10

CPU TURBO XT

	CPU 286/12	CPU 286/10	CPU Turbo XT
Standard Features			
CPU .	80286-12	80286-10	8058-1
Clock Speed (MHz)	6, 8/12	6,8/10	4.77/10
Wast State	Zero, Norton V3 SI rating: 15.3	Zero, Norton V3 SI rating: 11.5	Zero
RAM	512K BRAM (80ms)	512K DRAM (100ms)	640K
On Board Expansion Memory	Up to 4MB	Up to 4MB	Up to 640K
System Expansion Memory	Up to 16MB	Up to 16MB	Up to SMB EMS
Math Co-Processor Support	80287	80287	8167
Controller Card Handles	2 hard disks, 2 floppies	2 hard disks, 2 floppies	2 floppies
Disk Drive(s) Included	1.2MB floppy drive	1.2MB flappy drive	360K floppy drive
Clock/Calendar	Yes, with 10-year battery life	les, with 10-year battery life	Tes
Ports	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter	1 serial, 2 parallel, game port
Expansion Slots	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	8 8-bit
Keyboard	101-key enhanced	101-key enhanced	84-key standard
Power Supply (watts)	290	200	150
Reset Switch	Yes, with 2-second safety delay	les, with 2-second safety delay	Yes
BIOS	Phoenix	Phoenix	DTK
Warranty	18 months	18 months	1 year
System Configurations			
Monochrome System w/Hard Drive	\$1,135 \$1,530 (40MB)	\$1,035 \$1,285 (29MB)	\$595 \$890 (20MB)
EGA System w/Hard Drive	\$1,585 \$1,990 (40MB) -	\$1,485 \$1,735 (20MB)	\$1,045 \$1,340 (20MB)
Special Note	Features Selectable System Bus Timing for add-on board compatibil- ity Moda in U.S.s.	Also available in optional full size case with five drive bays.	\$595 Complete. Includes 12' high resolution monitor and Hercales

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Warranty.* So ask your dealer about the new bundled package that gives

you serious CAD draw ing tools. PC MOUSE and AutoSketch.



PERSON products residable to BILE, XT, ATP to 2th and spring a requirement of the ST of the ST

net cards supplied by Torus Systems.

When power was lost to the network stations, the server could not recover and reboot if other stations were attempting to contact it after a reboot. So after a power bump, you must turn off the nonserver stations until the server is powered on.

Tapestry's excellent electronic mail system notifies you of incorning mail and has the ability to attach binary files to outgoing messages. The printer spooling system is also excellent. It notifies you of completed jobs and makes selecting available networked printers easy for any user.

Overall, Tejestry burdens the network installer and administrator and doesn't give them anything back in the way of diagnostics of troubleshooting tools. The total environment Tapestry offers makes it easy for novice users to start applications, but users who know DOS will have little use for that knowledge.

—Frank J. Derfler, Jr.

—Frank J. Derfler, Jr.

10NET

"Very good gets much better" described 100ET Communications' 10NT LOSS 50 per node, \$395 for fifter-optic versions that are extra-priced options or unavailable seven on heavy-shiring networks from Noterior to the control of the control of the term of the control of the control of must use the 10NET notfures with the 10NET cards (and vice versa). The software includes electronic mail, public calendar, bulletin board, communications and management reporting programs and management reporting programs.

Since IONET is based in DOs and allows peer-to-peer resource sharing, it's slower than networks requiring dedicated servers but more flexible. Release 3.3 includes disk caching that significantly improves performance and adds NetBIOS services for gateway and mail products using NetBIOS session services. The IONET architecture offers a great

deal of flexibility in network configuration. IONET allows any workstation to contribute resources such as disk drives or attached printers to the network. Any user can move to any network node and have full network privileges.

The three IONET disks contain the

nain network program for every worksttion and several utility programs for novement of the several programs for noveltrations that don't share resources, for NoVtrations that don't share resources, for stations that don't share resources, for Sations that are as severas and share their resources lose over 300K RAM to flowErand DOS. More RAM can go to disk cache if extended memory is unavailable, but it's easy to terminate the floWEP program in order to free up memory for running large local applications.

CHOOSE COMMANDS OR MENUS IONET users have a choice of entering commands (either directly or through batch files) or using a series of easily accessed menus. Many network menus are RAM resident, so you can access facilities like CHAT and printer spooling from within an application.

Fox Research (the original name of 10NET communications) released to 10NET programs with a series of commands borrowed from mainfram centers, such as MOUNT (gain access to a shared resource), in response to the posture discovery of the MS-Net redirector, Fox agginative or the MS-Net redirector of the MS-Net redirec

STRONG SECURITY INDETS access security features are strong and flexible. Each person at a station contributing resources to the network, such as a disk drive or a printer, can set security restrictions on the use of the resources. You can assign security "levels" to each network user. To grant access, the user must have an equal or in the device. You can also protect individual files the same way. INDET even lets you assign different security levels for writing and reading an individual file.

MORE FEATURES AND UTILITIES
The list of features and utilities included in
the 10NET networking software is longer
than that of any other LAN, regardless of
price or architecture. 10NET includes
printer sharing, calendering, diagnostics,
electronic mail, and station-to-station
communications. Some features, such as

station-to-station communications and diagnostics, are available from RAM-resident menus. Other utilities, such as electronic mail and group calendaring, run as application programs.

A network with distributed resources requires solid station-testation communications. You have to be able to send a quick message to the person next to the letter-quality printer to ask if letterhead paper is loaded or to the person with a hadis to ask if a file is current. We refer to this as nearly message to be considered to the person with a hadis to ask if a file is current. We refer to this as nearly message to the middle of your work. OWET has an excellent rude-messaging capability, at's casy to use and also easy to lock out.

CB is IONET's unique station-to-station capability. Just like the popular CB service on CompuServe, it allows network users to engage in multipoint public discussions over the network. A utility called CHAT allows private point-to-point onscreen real-time discussions.

TALLYS, NETSTAT, and NETLOG are three 10NET administrative features. TALLYS gives an immediate report on technical network parameters—such as the number of packets sent, received, and acknowledged; full buffers; collisions; bad





10NET Communications 7016 Corporate Way Dayton, OH 45459-4223 (513) 433-2338 List Price: Software, \$495; bundled with board, tan box, cable.

software and documentation, 5695; fiberoptic version, 5895; unbundled NeiBIOS version 5395; NeiBIOS version 5695; Requiress For workstation; 192K RAM one disk drive, DOS 2.0 or later. For server: 396K RAM. In Short: This flexible integrated network.

with peer-to-peer resource sharing and DOSbased servers. Take many features not standard on other packages; you must use 10NET hardware with 10NET software, and vice versa. Excellent printer-sharing utilities and unaque group-calendaring features are included. Not copy protected. CRECE 400 OFFERDERSERIES. CAPO. packets; and statistical errors. NETSTAT describes the resources available to any user on the network. It displays the name of the node, users of the node, and the utilities available. NETLOG is a management tool that reports on the users signed into a network superstation. It gives a good picture and audit trail of the major actions taken by specific users on that station.

The new 10CACHE utility lets you set aside RAM on a station acting as a server for disk caching. A minimum of 70K RAM is required. The caching is effective, and an excellent cache performance screen gives statistical information you can use to "tune" the size of the cache. The 10CACHE program can run in extended or

expanded memory.

The 10SPOOL utility intercepts and holds printing jobs until the specified printer is ready. Several screens give the status of the jobs in the spool. You do have to remember to close the spool to send a job to the printer. We particularly liked that the spool program sends a message back when your job has finished printings.

10MAIL is a store-and-forward electronic mail system that runs on each individual PC but stores the message files it creates on a single shared hard disk. Text can come from a built-in text editor (with overwrite, insert, and full-screen cursor movement) or from a text file. But you cannot attach binary files to a 10MAIL message.

10NEWS is a simple electronic bulletin board that would normally be used by the network administrator to announce completed or proposed changes to the system. Anyone on the network can use it to make any type of announcement.

The 10NET calendar (a utility people ask for frequently and almost no other LAN vendors offer in their basic packages) allocate free or busy periods on a public calendar. It's a handy way to schedule meetings, certainly beating the "When are you free?" telephone exercise that workgroups must frequently perform.

If your network needs are best satisfied by a network with peer-to-peer resource sharing and DOS-based servers, we recommend IONET highly. It's perfectly suited for office or classroom applications. —Frank J. Derfler, Jr.

3+Share

ACon Com 's network operating system, 3+Share ISI 005 for one in five users, doesn't fit neatly in the categories of network operating systems. The 3+server software has MS-DOS at its core, and the workstations use the MS-Ner redirector. 3+Share requires an investment in dedicated server hardware, for which it teturus excellent performance. The lastest versions of the software, 3+Share, Version 1.3, and 3-Plan for Macinisch, link MS-DOSand account of the software of software of the software of so

3Com is working on its fourth generation of networking software. Bob Metcalle, one of 3Com's founders, invented Ethernet, so the first generation was the development of the Ethernet/NNS protoots standard at Xerox. The second generation, 3Com's first product as a company, was Ether-Series. The third, and present, generation is 3+50mer, while the newly Land Monagor. Each presention has supply to include the emerging handware and software standards of its time.

The development of the Ethernet/XNS protocol identified both the physical media and the protocol to accommodate the amount of data that Xerox envisioned in the paperless office of the future. With the second-generation EtherSeries, 3Com developed a network operating system that integrated DOS-based PCs into one network for sharing high-priced peripherals.

The original limitations of MS-DOS severely restricted the ability of EtherSeries and other DOS-based network operating systems from sharing data within an application running on a network. MS-DOS 3.1 and later versions try to address this problem by providing commands for both record and file lockine.

Together with the enhancements to DOS, Microsoft and IBM developed PC-Not. PC-Ner included three protocols and interfaces that became models, if not "standards," for PC-based networks the Microsoft Redirector, NeBIDGs, and incrosoft Redirector, NeBIDGs, along portated three developments into its present networking software, 3+Share, which retained the dedicated server concept and offered significantly better performance.

CORE OF THE SYSTEM The core of

3Com's network operating system is 4+8hare with its adjunct 3+4henus. The 3+Menus system lets the administrator build menus guiding the use of the resources of the network and local computer. The LAN administrator can use the menu system to design various degrees of insulation between novice users and both MS-DOS and 3+5khare.

Besides 3+5hare and 3+Menus, 3Com has a series of optional products. 3+Mull, an electronic mail package that is obth powerful and simple to use, provides all the fundamental e-mail message services as well as the ability to attach a number of DOS files to any message, 3+Remote is an add-on product giving people diafing into the server the capability to act as a local network workstation.

EASY TO INSTALL Version 1.3 of 3-4 Share, designed to support 3Com*s new 80386-based server, uses the 80386 architecture by making 32-bit memory moves internally, Some of the best news is that the program is easy to install, 3Com*s new line of servers (35:00 and 35:400) comes with all the basic software preinstalled, and you also get a copy of the soft-ware or disks.





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Novell for NetWare 2.1. Our HC Series drives increase NetWare's performance while supporting all

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CIRCLE 225 ON READER SERVICE CARD

Since DOS comes with 3+Share, you get ready-to-run workstation boot disks that bring you into the network. Install the cables and cards, boot the disks right out of the box, and you are "on the air."

The system comes up with menus and some users installed, and with applications ready to customize and install. System installation that used to take a couple of hours now takes just a few minutes (not counting cable installation).

VABLET OF MODILES 3 4-Share of the first hair with of network sortice, In includes modules called the Process Manager, Concurrent Input Output System, 34-File, 3-Print, 3-Print, 3-Print, 3-Print, 5-Print, 5-Pri

SIOS.

"Com designed each level of 3+Share with software medules that conform to the SIO (Open System Interconnection) model. In an etwork workstation, 3Com implements these modules as standard bod drivers loaded by CONFIG.SYS at boot-up. The networking software requires over 150K of RAM. If you buy 3Com's top-of-the-line network adapter card (with 256K of on-board RAM), most of the drivers will mun in the adapter's memory.

The modularity of 3Com's protocols let them support NetBiOS in two stages. Initially they emulated only the essential interrupt calls. Starting with Version 1.2.1 of 3+3hare. 3Com's software supports the full specification, running NetBiOS on the workstation and the Loxator module on the server. Most of the LAN-to-mainfrom module on the server. Most of the LAN-to-mainfrom galeways now on the market need these re-

The Process Manager (PM) module allows a network server running 3+Share to perform multitasking. It realizes that not all tasks are equal—some are slower than others. By switching back and forth between tasks, the PM seeks to use hardware resources as efficiently as possible.

Both MS-DOS and the PC's BIOS were designed around single-tasking and

one-at-a-time disk access. If multiple workstations needed to access a network disk simultaneously, the contention between them would cause the ROM BIOS to lock the system. To get around this problem, 30cm developed a Concurrent

input Output System (CIOSYS).
CIOSYS provides two main services.
First, it queues and processes multiple disk accesses requests (according to disk location), using an elevator-type froirity system. Second, it provides caching of both disk FATs and of most-recently used data. If the server has expanded memory, all caching occurs there.

3Com used the concept of a network name (the company calls it a "sharename") as a way of sharing network resources. Any user can establish a sharename and assign it access rights and a password. Other users can then link a DOS drive flowical) to the sharename.

Network security depends on the system of access rights and passworks. The security system has another important aspect. Under 3 **Jame the root directory of each partition belongs to the server user. Thus no other user—not even the network administrate—has access to another user's brone directory without permission. When a project member transfers to another or project, the LAN administrator simply or project, the LAN administrator imposs condition of the project in the continue pass condition of the project in the condition of the process of the condition o

DEDICATED SERVER APPROACH
3Com designed its 3Server line of network
servers as dedicated servers. Although the
software allows you to use a PC as what
the company calls a concurrent server—as
both server and workstation—3Com does
not recommend doing so because the software is largely memory resident.

The dedicated server approach 3Com does recommend lets the parts of the DOS memory map reserved for slots, video memory, and other functions become available for use as RAM. The extra RAM allows the server to run more software and to have more buffers without resorting to expanded memory.

The 3Servers set expanded memory aside for caching. They cache both the FAT and the most recently used sectors of each partition. So a 3Server (with an

80186 processor) provides better performance than a PC Server (with an 80286 processor). It is also capable of running more 3Com program modules simultaneously and giving better performance.

nodesy and giving core periorinance.

One of 3Com's most-significant new products is the 3S/400 server, built around a 16-MHz 80366 processor. It represents a major design philosophy departure for 3Com servers. On the one hand, 3Com has added four AT-type slots to the server, adding greater case of "im-server media bridging" similar to that of Novell, using

Since under 3 + Share each partition's root directory belongs to the server user, no other user—not even the network administrator—has access to another user's home directory without permission.

3+Netconnect. On the other hand, it has upped the level of architectural sophistication. To improve performance and speed, 3Corn has added mini/mainframe type features to the servers.

The system memory is triported: the CPU, the Ethernet expressors, and the SCSI controller can simultaneously access different parts of memory. 3Com has further optimized the disk and controller subsystem. The subsystem includes a highperformance (16-millisecond) 150MB hard disk, the controller supports overlapped seeks on multidrive configurations, and the subsystem supports out-of-order data transfer and uses a 1:1 disk interleave factor.

3+ FOR MACINTOSH 3Com, which puts an AppleTalk port on every 3Server, has introduced software to integrate Macs and PCs on the same network: 3+ for Macintosh. Now Mac users can have all 3+Share services, including file sharing,

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printer sharing, and e-mail. They can tie AppleTalk hardware to the 3Server, and those with slotted Macs can insert a 3Com Ethernet card for the Mac.

3+ for Macintosh offers full internetworking features and security. The Mac user interface is compatible with Apple Share. Network Folders representing network resources appear on the desktop. You use the Chooser on the Apple menu to select the directory you want to operate in. If Apple and PC applications have the same file format, their data files are immediately available to applications on either or both machines. 3+ for Macintosh, though, does not do application-specific data file translations.

OS/2 EXTENSION PROMISED 3Com and Microsoft are jointly developing the OS/2 LANManager, one of the promised extensions to OS/2, slated to provide network support. 3Com calls this system 3+Open. The approach to the extension assumes that the basic operating system on both the workstation and the server will be OS/2. According to 3Com, this assumption is in tune with IBM's LAN philoso-

phy OS/2 has a programming interface called Pipes; 3+Open will extend these with Named Pipes, Essentially, Named Pipes associates names with software running on a workstation (or the server). This allows program-to-program communication and distributed processing.

Overall, where 3Com tries to adhere to industry practices and standards, Novell attempts to create its own standards with specifications such as value-added processes. Where 3Com's designers worry about future flexibility and backwards compatibility, Novell looks for high capacity and power. Where 3Com designed products to provide interoperability with AppleTalk and Token-Ring, Novell sought media independence.

The only area in which Novell's NetWare and Banyan's VINES surpass 3Com's 3+Share today is that of management tools and statistical reporting. NetWare and VINES make it easier than 3+Share does for a manager to monitor the performance of a server, to control user entry, and to determine exactly who should pay for what. No doubt 3Com will can share or use any other workstation's

remedy this imbalance with 3+Open. -Walter Adams and Frank J. Derfler, Jr.

TOPS

Using the TOPS interface card and software, from TOPS (formerly Centram Systems, now owned by Sun Microsystems). you can link PCs with Apple Macintoshes and UNIX computers.

Since the Mac has become a legitimate corporate tool, the \$490-per-node TOPS can be a valuable way for companies to share data and printers among PCs and Macs. Other developments are making such connections easier and Macs more valuable. In fact, new Macintosh computers have a built-in network interface port for the AppleTalk telephone wire connec-

The TOPS network interface cards for the PC work only with the TOPS software. and you cannot use NetBIOS as a standard interface between the interface card and other network operating systems. But the TOPS software works with several PC network interface cards designed for compatibility, including a new Hercules card called Network Card Plus (combining Hercules monochrome graphics and networking), the TandyLink card distributed by Tandy Corp., and Apple's own AppleTalk card for the PC.

The software provides the translation facilities enabling the different vendors' machines to share files and peripheral devices. TOPS, with an architecture designed for flexibility and simplicity rather than speed, can link up to 32 computers on the network. You can bridge the network. with multiple networks mixing any of the supported computers. TOPS provides specialized software for each of the different vendors' machines, allowing them to run on the network.

TOPS acts as a standardized environment, providing universal file-access protocols. It handles the problem of incompatibility between systems by translating local requests of a certain machine's operating system into a request it recognizes in

The TOPS network is a neer-to-neer network, meaning that any workstation

any machine on the network.

files and devices. The latest version, 2.0, lets any station on the network make an attached printer available to the network.

If you use a PC or compatible, your applications can use TOPS to access data stored on another PC or on a Macintosh. You can refer to a Mac's drive just as you would a floppy or hard disk on your own PC. If you are using a Mac, PC volumes appear on the Mac screen as disk icons. just as if they were on the attached drives of the Mac.

TOPS for the PC, or TOPS/PC, is a functional, basic, easy-to-install network for PC-to-PC networking. TOPS/PC isn't as fast as many PC-to-PC networking altematives, but it isn't as expensive or difficult to maintain as some of these alternatives are. TOPS/PC lacks, however, the electronic mail, calendaring, security, and administrative features found in competing PC-only products like 10NET.

SOFTWARE MODULES The TOPS networking software modules intercent certain DOS calls, redirect them out through the network, and answer requests for services coming in through the net-





TOPS, Version 2.0 TOPS, A Sun Microsystems Co. 950 Manna Village Pkwy. (415) 769-9669 List Price: For network

software required to put one PC on TOPS Network, \$189; hardware interface product. \$239; \$59 for TOPS teleconnector, which is required for use of network Requires: 200K RAM, one disk drive, and DOS 2.0 or later

In Short: Designed for flexibility and smoplicity rather than speed, TOPS offers a valuable way for companies to share data and printers among networks comprising up to 32 PCs. Macintoshes, and UNIX computers. This software hardware matchup is best recommended for PC/Mac file exchange, PC integration into Muc networks, and access for PCs to Apple LaserWriter products. Not

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IDEAcomm 3278/DFT/MC, Nov. 1987 Local Mainframe Communications for the IBM PS/2



8MB and Ports for the PS/2 Model 30

On April 2, 1987, IBM brought the world to a standstill when it brought the PS/2 to life. Now while everyone else waited to see how

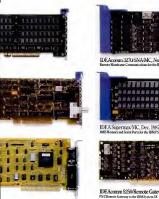
this latest offspring would be accepted, we quietly set out to create products that would help the PS/2 reach its fullest potential. And two months later, we delivered.

In fact, we were the first to devise completely functional local and remote links between the PS/2 and System 3X minicomputers. First to offer local

and remote gateway communications for the PS/2 on a local area network. And first with a Micro Channel* board that adds up to 12 megabytes of memory. Our list of firsts didn't start with the PS/2.

either. For example, we pioneered the industry standard in backplane design for multifunction boards. And we were the first to fully apply surface mount technology, which allowed us to put all the basic computing functions onto one PC board. (Interestingly enough, a year later IBM

esbirth to a new PC, to send out cards.







8MB Memory and Serial Ports for the IBM PS/2



IDEAcomm 5250/Remote Gateway/MC, Dec. 1987 PS/2 Remote Gateway to the IBM System 3X



1/O Card for the IBM PS/2

used surface mount technology to create the PS/2.) The ability to conceive products quickly stems from our corporate commitment. Since our inception in 1982, our goal has been to do more than enhance IBM's personal computers. It's been to truly advance them. Our in-house research and development team meets this goal so well, it continually develops PC

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work. Some modules give users an optional menu of service; others accept inputs from the DOS command line or batch files. A background print-queuing module holds printing jobs until the networked printer is ready to accept them.

Several TOPS program modules reside in memory in each networked station, taking about 192K RAM away from applications in a PC workstation. However, keeping these programs in memory lets them operate nearly invisibly in the background mode. TOPS offers a way around the loss of this memory through the use of a HIcard from RYBS Electronics (\$249, minus a 10-percent discount). In a typical installation, the HIcard makes 629K RAM available for DOS and applications.

INTERFACE TOPSMENU, an interface for end users, consists of a series of menu and submenu options to manipulate the TOPS system. The main menu is divided into Client and Server options. A Client is a station using a volume (directory or subdirectory) published (made available for sharing) by another station. A Server is a station that has made files on its disk drive public or available to the network.

Using the Client submenu, you can list the available servers on the network, list the volumes published on a server, attach to a volume so it becomes a virtual disk drive, choose an access mode (read-only or read/write capabilities), and detach from a volume. On the Server submenu. you can list directories on a drive, publish a directory to the network, list clients attached to your networked drive, make parts of a drive unavailable, change a password, and perform other functions. TOPS-MENU allows you to address designated files with an "alias" (normally a meaningful title like RECEIPTS) instead of requiring you to know path and file names.

To accommodate more-advanced users and to automate TOPS instructions through batch files, TOPS has a commandline interface that offers all of the functions accessed through TOPSMENU. The word TOPS serves as a prefix to all the TOPS commands, and you activate the command interpreter, TOPS.EXE, when you type TOPS followed by a command and its parameters on the command line.

The inelegant security scheme is more

effective against operator errors than determined attempts at access. You can optionally attach a password to the files you make available to the network. Additionally, you can specify if users have only read or both read and write privileges.

SOME USES, NOT OTHERS If you want to do a lot of database management over the network, we recommend using another system than TOPS. If you want to use a 3270 LAN gateway, we think you can find better connectivity alternatives. But if you want to exchange files between a PC and a Mac, integrate a PC into a predominantly Mac network, or give PCs easy access to Apple LaserWriter products. TOPS is an excellent choice. -Frank J. Derfler, Jr.

ViaNet Networking Operating System

Like IONET and TOPS. ViaNet Networkine Operatine System, from Western Digital for \$99 per node (plus network interface card), uses MS-DOS as its base but is not derived from MS-Net. ViaNet is a mature operating system that is easy to set up and. partly because of its DOS kinship, easy to use. Also like IONET and TOPS. ViaNet is the product of a small company that was later acquired by a larger firm. Western Digital now owns the company, but other vendors still sell and support ViaNet with their own hardware.

Versions of ViaNet are also marketed for UNIX and Xenix systems. According to the documentation, files and directories on nodes running under UNIX or Xenix appear on the directory of DOS-equipped machines on the same network. This doesn't guarantee file compatibility for application programs, but it does allow file access, file transfer, and printer sharing. ViaNet also includes a virtual terminal facility, so PCs can use the network attachment to act as terminals and run programs on a UNIX or Xenix host.

Multiple marketing channels means that several versions of ViaNet are available. Western Digital now markets a version of ViaNet to integrators that is able to drive any networking card having a Net-BIOS interface.

RESOURCE SHARING ViaNet allows any workstation on the network to share resources with the network (although typically only machines with hard disk drives act as print spoolers). The authors of the ViaNet documentation clearly appreciate the complexity of managing a network in which stations also act as servers; they give you a series of forms to document and describe the available resources of every station. The program disks include the forms in ASCII files

Western Digital made a smart move when it added the programming commands and syntax Microsoft used in MS-Net (and therefore those that IBM used in the PC Local Area Network Program) to ViaNet's command structure. The same training, experience, and batch files gained with MS-Net-based products carry over to ViaNet.

ViaNet has a unique method of displaying available resources. When your workstation enters the network, the network becomes drive Z:. At sign-on, you are shown a directory of all subdirectories on drive Z:. These subdirectories are actually the node names of computers on the network making resources available to the network.

ViaNet lists them by the node names the network administrator assigns. To access these resources, you use standard DOS commands like Change Direc-





Version 3.06 Western Digital Corp. 2445 McCabe Way Irvine, CA 92714 (714) 863-0103 List Price: \$99 per node Requires: 128K RAM, one disk drive, DOS

In Short: This DOS-based network allows any node to contribute resources: it's easy to

install and use if you know DOS, but performance is only average. Unique strengths include the ability to tie UNIX. Xenix, and DOS machines in a resource-sharing network and its use of a visual DOS-tree structure for using those resources. Not copy protected CRCLI 666 INREADERS

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CIRCLE 395 ON READER SERVICE CARD

tory (CD). After you change directory into the node name, you see as subdirectories the resources available on that node, for example, A. B. C. LPT1. Executing another change of directory links you into the resource. To access files on the C. drive of a computer with the node name of IBM-PCAT, for example, you sign not here network and took at the directory of the Z. drive of the ATT with the property of the C. drive of the ATT principle. The principle of the ATT with a drive of th

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ViaNet's unique strengths include the ability to tie UNIX, Xenix, and DOS machines in a

resource-sharing network.

Any application running on your machine can access the AT's C: drive by sending DOS requests to your Z: drive.

One interesting aspect of this approach is that you can set a DOS PATH to several resources simultaneously. In this way you can draw program files from one server and access data files on another server without using complex server-naming schemes.

Wa/Vr holds the names of the resources available on every workstation in a SVS file on each individual macipier's local drives. The network administrator makes devices available or unavailable to the network by editing this file. The administrator can substitute network names for network directory path strings. Changing directory into the network name ACCOUNTS on the Z drive can take you through a much more complex nesting of subdirectories more complex nesting of subdirectories.

Entries in the .SYS file also determine file and directory protection. ViaNet assigns individual read and/or write access rights to individuals and groups. The ability to link individuals with a group having certain rights makes moving and deleting users easier.

ViaNer's print-spooling utility is efficient. You send a file to the networked printer from within an application program by hitting Cut-Alt-PINSc. A programming command. VIAPRINT, then sends an existing text file to the print spool. This command may include arguments that put the text into a predefined form for printing or that modify the text according to a specific format.

You pay a price for ViaNet's flexibility. On our IBM PC AT running DOS 3.3, the networking software and DOS used about 178K RAM.

We like ViaNer. It's easy to install, and users comfortable with DOS find it easy to use. Its unique strengths include the ability to tie UNIX. Xenix, and DOS machines in are source-sharing network and the use of a visual DOS-tree structure for using those resources.

Overall, ViaVer's performance is no better or worse than the average DOS-based operating system with nondedicated servers. Yet since ViaVer did not handle small data block activities (like those of a multiuser on-line database) as efficiently as other programs, its overall performance on our benchmark tests looks worse than our practical experience indicated.—Frank J. Derfler, Jr.

VINES

VINES, from Banyan Systems, is the most minicomputer-like LAN operating system we reviewed. While a version of the \$1,895 (for ten users) program is available for the 80286 processor, the operating system comes alive when a Banyan 32-bit server with the Motorola 68000 series processor is its host.

A VINES server is a dedicated machine requiring a separate RS-232C connected terminal for controlling and monitoring the UNIX-based operating system. Each separate feature of VINES, like electronic mail or 3270 communications, runs as a separate task in the server.

We previously looked at VINES as marketed by Tallgrass Technologies (PC Magazine, January 27, 1987) and as integrated with Northern Telecom's Meridian LANStar PC packet switch system (PC Magazine, March 29, 1988). This review examines VINES, Version 2.11, and looks





HAVES, Version 211 Banyan Systems Inc 115 Flanders Rd Westboro, MA 01581 (617) 898-1000 List Price: Priced according to server: \$1,895 for support of ten users

and up. 5095 for VIVEAZ/SVS. \$1,805 for base system software inceeded in run on one board) for unhunted users, full range of integrated options each at additional cost. No cost for upgrade. Requiress For workstation: 250K RAM, DOS 2.0 and later. For server: ZMB RAM, hard disk, and one floppy disk down. In Short: The powerful LAN operating sys-

hard disk, and one floppy disk drive. In Short: The sovertul LAN operating systein is best into on a Banyan server with a 68000 cene processor Version 3 0 will add new management tools, the ability to have networked pratices on workstations, and amproved performance. VIVES is communications capubilities are particularly storog. Not copy proceeded.

at the features Version 3.0 will offer. (We also examined a beta version of VINES 3.0, which should be on the market by the time you read this review.)

VINES is powerful: one machine functions as print server, file server, and communications server. (Print server functions will be distributed in VINES 3.0.) VINES has no peer-to-peer sharing of disk drive resources between workstations. The UNIX operating system takes care of multiuser multitasking operations.

Each time the VIMES server is turned on, the software examines the hardware configuration in the server and reads in the right drivers and interfaces for the hardware. The server can internally bridge in doctor 10 effect the video variety of vivers for different interface cards available in Novell's NetWare (Novell has more than 30), but the program can automatically address the 17 most peoplar interface cards, the term of the vivers of the vivers of the vivers uses, but it is almost completely automatic and, in our experience, trouble free.

You can perform the initial installation or upgrade of VINES on a Banyan server

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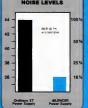
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almost with your eyes closed. You insert a tape cartridge into the drive and select a few items from a simple menu. Everything else is automatic.

FULL PLATE OF FEATURES The VINES product line includes a full plate of features and enhancements. The Base VINES system includes Net Manager, a powerful administrative and troubleshooting utility, a good menu system for users and supervisors, NetBIOS emulation services, and excellent performance.

Many options are available, including an excellent electronic mail package and various communications capabilities that, for instance, allow for a lot of communications between the network and other devices or between multiple network servers. Whether you want to hang shared moderns off the server, bridge networks, or make 2370 connections, VIMES gives you a

good way to do it.

VINES also features one of the best remote dial-in facilities in any network system. You can call into the network using a laptop in a phone booth and have virtual
drives and full use of the network. Use
causin choosing what tasks you do, because every action tries to push a lot of
packets through a slow telephone line: if
you have the time, though, you have the
access.

Despite the system's internal complexity and power for maybe because of it, VIMES is easy for both end users and system administration to manipulate. A relatively complex naming scheme for servers (GreecTalls names in Banyan's terminology) allows you to find and use files, printers, and services like electronic mail and NetBIOS. Virtual links between DOS manes on the workstation and resources on the servers are easy to make, either through the menu system or through direct commands. The operations, the volume of the servers are cast you stem, in additionable to the servers are cast you stem, in additionable to the servers are cast you stem, in additionable to the servers are cast you stem, in additionable to the servers are cast you stem, in additionable profile information or every user.

VINES's commands for programming commands the operating system are similar in concept and syntax to those of MS-Net. Issuing a listent with the command, for example, connects the workstation's drive or printer, to with a networked drive or printer, to with a networked resources or printer, to without the printer of the



• SFT NetWare 2.1

Because networking software clearly falls into two categories, dedicated server and peer-to-peer, we've selected one Editor's Choice for each. Both of these front-runners had better keep up the pace, however, because two dark horse candidates are sneshing wo not he inside.

If you need the power of a dedicated server, then the speed, efficiency (on an 80286 processor). and features of Novell's SFT Net-Wate 2.1 make it an easy choice. NetWare, in its many versions, is compatible with a wide variety of hardware, includes utilities ranging from menus to mail, and now has features previously available only in minicomputer operating systems. These capabilities include producine network statistical reports allowing access according to time and date, and assigning costs for services according to usage, storage, and connection time. The SFT NetWare 2.1 we tested lists for over \$4,000 and takes patience and perhaps training to install, but it is an industrial-strength product that is equally effective moving a byte or a gigabyte of data.

While SFT NetWare 2.1 is impressive, the award for the most promising challenger in the dedicated server category must go to Univation's LifeNet. LifeNet has delivered on operating system able to use the 80386 processor in protected mode and its shipping what appears to be a practical database server system using the DataFSV. With a starting price of \$1.495 (plus opinions such as TCP/IP). LifeNet doesn't have all the features or the wide base of support of NetWare, but what it does have is impressive.

In the peer-to-peer category, the standard features and steady performance of 10NET give to the nod. I The 10NET software includes one of the best calendaring packages in the industry and many other features the chat, electronic mail, a good disk cache, performance reporting, and some diagnostics. At 805 m and some diagnostics of the start where the standard properties of the fairly wriced. But not a bareait

The shadow pacing 10NET has the unlikely name of Artisoft 1 Aux the unlikely name of Artisoft 1 Aux tastic Network Operating System. LaNtastic is neuperative (about \$230 per node buys the software and hardware) and small in size, and it includes features like e-mail and usage statistics. If Artisoft develops a strong dealer support and distribution structure for its tenture for the structure for the struc

and NetBIOS services what Banyan calls service names. You can access the service names through SETDRIVE and similar commands.

A user profile stores the links established through direct programming, or through the menus, which do the same things in more-structured steps. The user profiles and service names make it easy for a network manager to make changes to the A PEEK AT 3.0 Release 3.0 of VINES, which we saw as a beta version, is a substantial change to the program. Banyan's press announcements detail over 100 "improvements, enhancements, and features." The most interesting are in the areas of security, management, and (even more) communications interfaces.

The VANGuard security module gives the network administrator options typical of those available in mainframe operating



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systems. The administrator can limit the access time, force password changes, and perform other security practices.

VANGuard wisely encrypts passwords during transmission. The encryption scheme changes, so replaying the passwords won't work. Encrypting passwords is another improvement.

Our benchmark tests of the current version of VINES show good performance. but the system slows down disproportionately in our small-block-size (512-byte) transfer exercise. New code in VINES 3.0 promises to significantly increase the speed of small data block transfers.

Banyan's software designers made a smart move when they added an option allowing you to share network printers attached to nondedicated PCs on the network. Physically, this means you don't have to cluster all the printers next to the server. Operationally, it means that you don't have to burden the single server with

printer communications management.

The remote shared printers operate much like those physically attached to the server. The print job queue remains on the server, but it doesn't have to handshake with all those printers. On the PC, a 7K background program accepts text from the server. The program senses activity on the PC and slows down printing to give priority to the foreground PC application.

Because of its strength in communications, Banyan is a leader in providing Tranmission Control Program/Internet Program (TCP/IP) services through a LAN (see the sidebar "A Glossary of Networking Terms" in "Networking Acronyms and Buzzwords"). Banyan's new TCP/IP routing option allows a single Banyan server or a network of Banyan servers to connect multiple TCP/IP networks. This capability means that the network server can eliminate the need for a wide area network routing computer. A new Banvan TCP/IP server-to-server option lets people with access to TCP/IP networks link servers over the network. Thus, local area networks become worldwide networks.

MAKING INROADS Although Novell's NetWare clearly leads the LAN software industry in sales, companies like Banyan are making sure Novell doesn't become complacent. Proof of Banyan's strength is its strategic technical and marketing agreements with companies like Northern Telecom, which have resulted in products like the Meridian LANStar PC packet-switching network system.

With Version 3.0, VINES will have new features, speed, and maturity. We don't recommend running VINES on anything but a Banyan server and we sometimes dislike the syntax of the commands. but otherwise VINES gives us no reason to complain and many reasons to applaud. -Frank J. Derfler, Jr.

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It possesses superb talents such a small package, only 16" by 16". Fully XT compatible, the S300 runs at 4.77 or 8 MHz and is a powerful, yet economical

alternative. It is ideal for use as a stand-alone system or for inclusion as a workstation in a local area network.

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Because



The handsome piece of hightech wizardry you've just been admiring (on the previous two pages) is the new Dell System 220. The first 286

computer running at 20 MHz. You read it correctly, 20 MHz.

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-Eric Knorr, PC World

-Eric Knorr, PC World

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-Stanley W. Angrist, Forbes

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SYSTEM 310.

The top of the line. It's the highest performance 80386 computer available, faster than the IBM+ PS/2+ Model 80 and the Compaq+ 386/20. It runs at 20 MHz, with the latest 32bit architecture for complete MS+ OS/2 compatibility and maximum performance. Since it also has Intel's† Advanced 82385 Cache Memory Controller, and high performance disk drives, the System 310 is ideal for intensive database management, complex research and development, CAD CAM, and desktop publishing. As a network file server the system offers an unbeatable combination of price and performance.

Standard Features: Intel® 80386 microprocessor running at

20 MHz. 1 MB of 80 ns 32-bit RAM expandable to 16 MB without using an expansion slot.

Advanced Intel 82385 Cache Memory Controller with 32 KB of high speed static RAM. Socket for 20 MHz 80387 coprocessor.

525°12 MB or 3.5°1.44 MB diskette drive. Dual diskette and hard disk drive controller. Enhanced ROI-key keyboard. I parallel and 2 senal ports. 200-wart power supply. Real-time clock.

Real-time clock.
8 expansion slots (6 available with hard disk drive controller and video adapter installed).
Dell System Analyser.
MS-DOS and MS OS/2 compatible.
Security lock with locking chassis.

Security lock with locking chassis.

12 month on-site service contract
(Available on complete systems).

Options:

1 MB RAM apprade kit.

20 MHz Intel 2 MB or 8 ME boards.	80387 mai memory	h copro expanse	esso
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Denes	Mono	Color	Color Plan	Г
40 MB 28 ms	\$3,799	\$3,999	\$4,090	1
NO MENT OF PART STATE	\$4,999	\$4,799	\$4,899	0
250 MB III ms ESDI	\$5,099	\$5,299	\$5,399	*
322 MIS-18 ms ESD1	\$7,099	\$2,299	\$7,399	×



THE NEW SYSTEM 220.

As fast as most 386 computers, at less than half the price-more power for the money than any other system. An 80286 system that runs at 20 MHz, with less than one wait state. Completely compatible for both MS-DOS and MS OS/2 applications (it runs OS/2 faster than IBM PS/2 Model 80), and with a remarkably small footprint, the System 220 is the ideal executive workstation for database manage ment, business, or sophisticated connectivity applications. The system uses page-mode interleaved memory; the page-mode RAM operates at less than one wait state, and inter-leaving results in a performance increase of about 15 percent.

Standard Features: 80286 microprocessor running

at 20 MHz.

I MB of RAM expandable to
16 MB (8 MB on system
board).

Integrated diskette and VGA video controller on system board. One 3.5*1.44 MB diskette drive. Integrated high performance hard

disk interface on system board. Enhanced 101-key keyboard. I parallel and 2 serial ports. LIM 4.0 support for memory over I MB.

Real-time clock. Three full-sized AT+ compatible expansion slots. Socket for 80287 coprocessor.

Dell System Analyzer
MS-DOS and MS OS/2
compatible.
Security lock with locking chassis.
12 month on-site service con-

tract (Available on complete systems). Options: 3.5" L44 MB diskette drive. Intel 80287 coprocessor.





A great value in a full-featured AT compatible. An 80286 computer running at 12.5 MHz. this system is completely MS OS/2 compatible. It's ideal for general business applications, as well as software development, local area networks, CAD/CAM, and desktop publishing. The System 200 offers high speed drive options. industry standard compatible BIOS, and on-site service. At these low prices, the System 200 is the best value in the 80286 marketplace. As Executive Com puting said of this computer's predecessor, "If faster processing speed and low cost are two key issues affecting your purchase decision, this machine might be the ideal choice for your office." Standard Features:

Intel 80286 microprocessor running at 12.5 MHz

640 KB of RAM, expandable to 16 MB (4.6 MB on system board) 5.25" 1.2 MB or 3.5" 1.44 MB diskette Dual diskette and hard disk drive

controller. Enhanced 101-key keyboard I parallel and 2 serial ports 200-watt power supply Real-time clock

6 expansion slots. (4 available with hard disk drive controller and video adapter installed)

Socket for 8 MHz 80287 coprocessor Dell System Analyzer. MS-DOS & MS OS/2 compatible. Security lock with locking chassis.

12-month on-site service contract (Available on complete systems).

512 KB RAM upgrade kit.

SYSTEM 200-	4	hh Monm	e and Ad	gter
Harlina Direc	Moral	NUA Mono	VGA Culor	VGA Cultur Pl
20.MB	\$1,799	\$1,999	\$2,199	\$2,295
60 VID 40 ms	\$1,999	\$2.199	\$2,799	\$2,09
40.MS 25 Fin	\$2,190	\$2,399	\$2,599	\$2,699
WIME New USSI	\$2,990	\$3.199	\$3,779	\$3.499
Home Bricket	\$3,690	\$3.090	\$3,899	\$3,990
322 MB #1 ma ESEM	\$5.699	\$5 699	\$5.599	\$5,000



one-piece computer for office, school, or home. This system is fast, easy to use, and ready to run with Dell Enhanced MS-DOS 3.3, Microsoft† DOS Man-ager, and Microsoft Works software-more than a \$400 value. included at no extra charge Complete MS-DOS compatibility means you can run thousands of programs for business, per-sonal finance, education, and entertainment. And the System 100 can grow, with the high quality options listed below. A price leader in 8088 technology. the System 100 boasts an innovative design that allows for more power, speed and convenience

than most of its competitors. Standard Features:

Intel 8088 microprocessor run ning at 9.54 MHz selectable 640 KB of RAM. 3.5*720 KB diskette drive. Diskette drive controller integrated on system board.

ntegrated high-quality 84-key keyboard 1 serial and 1 parallel port. Two full-sized expansion slots

available when video adapter is installed. One half-sized expansion slot used for video adapter

Socket for 8 MHz 8087 coprocessor Internal speaker with earthone jack and volume control. Security Tie-Down bracket. Dell Enhanced MS-DOS 3.3

Microsoft DOS Manager, Microsoft Works.

3.5*720 KB diskette drive. 8 MHz Intel 8087

SYSTEM 100	Monor	Color	VGA Mono	VCA Color			
720 KB Delete Drive	\$799	\$999	\$999	\$1,199			
Yess 720 K2k Diskeste Desses	\$949	\$1,049	81.10	\$130			
20 MB Hard Date	\$1,299	\$1,399	\$1,499	\$1,000			



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Dual 250-sheet input trave Laser System 80 \$3,195 8 pages per minute text and graphics L5 MB standard memory, expandable

to 2.0 MB Laser System 60 \$2,195 6 pages per minute, text and graphics 1.5 MB standard me

expandable to 2.0 MB DOT MATRIX PRINTERS Printer System 800 \$699.95 Highest resolution text and graphics from a 24-wire dot matrix printer 4 KB buffer Draft quality at 200 cps

Correspondence quality at 132 cps Letter quality at 66 cps Standard parallel and senal interfaces Wide carriage

Printer System 600 \$499.95 9-wire dot mate Draft quality at 240 cps Near-letter quality at 60 cps Standard parallel interface 12.6 KB Buffer (expandable to 28.6 KB) Wide carriage

Printer System 300 \$199.95 9-ware dot mate Draft quality at 144 cps Near-letter quality at 36 cps Four standard fonts Paper parking Standard Parallel interface

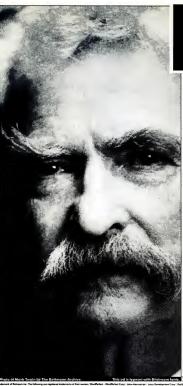
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WORKGROUP

PRODUCTIVITY BOOSTERS

Specially designed LAN productivity programs range far and wide in their efforts to streamline group interactions. They tackle e-mail, create menus, schedule meetings, perform desktop accessory and administrative tasks, catalog files, circulate documents—even redline changes. Each is different from the next, and no one program does it all.

A side from bonus checks or threats of dismissal, few things can improve workgroup productivity better than a local area network. Now a new class of software programs can improve the efficiency of LANs in boosting workgroup productivity.

LANs can make it easier for workgroups to schedule group events, exchange information, and work together to perform tasks. And they eliminate the "time tyranny" of communications.

LANs triumph over such productivitydestroying time tyrants as telephone calls and meetings by allowing you to receive information when you're ready for it—not just when someone else is ready to send it to you. The weapons that LANs utilize are electronic mail, databases, and other kinds of shared information pools.

But it takes a specially designed program to turn a network into a dynamic productivity booster. Workgroup application programs like the 17 we review here streamline group interactions and improve efficiency by using the network as a channel for group processes.

TWO APPROACHES These productivity programs take two different routes to the same end. Some, like FutureSoft's Right Hand Man, focus on the individual user and offer desktop accessories for enhancing productivity. Others, like The Co-ordinator from Action Technologies, structure the group process and the actions of the individuals within the group

In fact, sometimes the line between

these workgroup productivity packages and the eight LAN utility programs reviewed in this issue (see "Administrative Relief for LAN Managers") is a blurry one. The packages we review in this article are designed mainly for LAN users, while those in the article on LAN utilities are designed mainly for LAN utilities are designed mainly for LAN utilities are mainly for the network administrator. But network administrators will also find some beginning that the production of the second productio

DIFFERENT FUNCTIONS The programs we evaluated cover a wide range of territory. Some of the packages are TSR (terminate-and-stay-resident) software. Many of them include electronic mail among their features. PCC Systems' cc:Mail LAN Package and Consumers Software's The Network Courier are exclusively e-mail packages for LANs, but a number of others, including Spectre Software's Command Performance, also offere-mail alone with other functions.

Several of these programs include at least some degree of automatic meeting scheduling. A number also offer desktop

The market offers plenty of programs good enough to run on any LAN, but none dazzling enough to make you buy a LAN.

accessories like calculators and phone books. Shoebox 3, from R+R Associates, even finds available time slots for users to

Menu-creation and DOS interfaces are other functions of some of these work-group productivity programs. These programs attempt to act as interfaces between users and the network capabilities. Delan for the network capabilities are considered as the network capabilities. The network capabilities was not to the network capabilities are considered around a network. Barnel Software's Le Menu and Deer's 65t's Maggie Menu and Deer's 65t's Maggie Menu and Deer's 65t's Maggie Menu Soft southern from Leader Systems, is a DOS-batch-file-based menu progradu users to a network environment.

Handling management tasks is an additional function that some of these programs tackle. Higgins, from Conetic Systems, includes administrative functionshandled by memory-resident modules designed to operate tougher around a relational database. KeyLogic LANBatch altowa suyone on the network to seed work to a dedicated machine for processing, as well as no tell amother workstanton to do with the control of th

you through backup and archiving.

The heart of Connect Computer's Lanscope is a database management system that helps manage resources, supplies network and user activity reports, handles software license metering, and manages user/workstation menu systems. Brightwork Software's NETmanager allows you to keep track of LAN equipment and soft-

Some of the more-advanced products do specialized jobs like circulating a text file for editing and comment. One program, Jurisoft's CompareRite, is an "instant redimer," offering a way to indicate changes made to a document. Broderbund Software's ForComment can help you get comments on your documents from various reviewers on your LAN, without requiring you to so much as move a piece of paper or even a floppy disk.

NO DIAMONDS YET While we saw some pretty good programs, we found noting resembling a diamond—even one in the rough. None of the packages we testder vesseled anything that could programs popularized PCs. True, the market offers plenty of programs good enough to non any LAN you buy, but none diazzling enough alone to make you buy a LAN.

Still, the primary functions of a LAM are file exchange, equipment sharing, and simultaneous access of several people to the same data. These are good reasons pouring a LAM, and for buying programs that boost LAM users' productivity—even though at present more time and energy is needed to develop these programs into a vital commodifie.—Frank J. Derfer. Jr.

cc:Mail LAN Package

While software products like Higgion and The Coordinator combine electronic mail capabilities with other functions, PCC Systems 'SSO's Candil LAM Package is to be a complete e- mail service. It's unusualı nir sa billiy to attach 's snapshot' of ap-plication sereens to files, allowing you to like you want to be completed in the memory resident, though, so you must load if each time you need to use it. Gee "Making Connections: Two E-Mail Systems for



LANs," PC Magazine, December 8, 1987, page 303, for more details about this program.)

cc:Mail LAN Package has many powerful features, yet if's still easy to use. The package has a point-and-shoot menu system with a main menu and submenus for message reading, storage, and creation. The menu system is so clear that the PC Labs testers were able to use the system effectively and efficiently in a short period of time—without even reading the manual.

SHARING MAILBOXES Besides handling individual mailboxes, cc::Mail lets a defined group of people share a mailbox; and it also includes a public bulletin board service. cc::Mail users can establish private mailing lists and then share the lists with others.

Others.

If the local area network has dial-in and dial-out capabilities, cc:Mail allows you to exchange mail with other networks running the same software anywhere in the world. To perform such a transfer, the package knows enough to call automatically over the telephone lines and transfer the message.

A full-screen text editor helps you create messages, and the program makes it easy to find the name of the mailbox you want to send the message to. Getting the right address can be a challenge with some other e-mail systems, but cc:Mail's features, like its annotated lists of mailboxes.

make finding the right address easy.

Handling received messages is easy, too, because the program can sort them any way you want, using the sender/subject/date information that comes on evermessage. Transferring binary files is as simple as selecting the Attach Copy of DOS File option from the menu. The program displays directories to help you find the files you want.

TAKING SNAPSHOTS cc::Mail also allows you to capture graphic images with its Snapshot utility. You can then attach them to an outgoing message, just as you would binary files. When you receive a message with a graphic image attached, a menu option lets you jump between the text and the graphics files so that you can compare the

image with its text description.

The package offers password security and, for additional security, stores the message files in an encoded binary format. It also includes several utilities for the mail system administrator that show user activity, help organize files, and free up cluttered file space on the disk drives.

cc:Mail can carry the mail on any LAN
effectively—with little or no user training
and a low administrator work load.
—Frank J. Derfler, Jr.

Command Performance

To borrow a popular phrase from word processing and desktop publishing, "what you see is what you get" is also a good way to describe Spectre Software's Command Performance (5695 per server). Released originally as a standardon process and called Moartor, this package gives you a customized mem system for each LAN workstation. It also offers a meeting—well as a number of single-baser desktop accessory functions and menus for DOS commands.

A sign-on screen appears when you first turn on your terminal, and you need to supply a password to gain access to the main menu system. The 1-2-3-style main menu gives you access either to the application programs, a personal accessories menu, or a sign-off command.

The application menus are customized for each user, simplifying network use and





manuals and LAN ad-

ministrator's manual).

Requires: 260K RAM, DOS 3.1 or later.

In Short: This good menu system and DOS interface is composible with a wide variety of network operating systems and lisculdes excellent front-end security; it also offers a set of useful desktop accessories. Not copy protected.

offering additional security. Main menu choices can also call submenus; in fact, the Personal command on the main menu calls a menu to access the nonnetworked desktop accessories as well as the networked electronic mail system and meeting sched-

DAYS GO BY You can activate a calendar from most of the menus by pressing the F3 key. Since the calendar is unrelated to the excessories, it's merely for reference. It usually displays the current month and highlights the current day, but you can seroll it to access other dates.

When you choose the planner from the personal menu, ascreen for the current day opens with an appointment schedule and a ten-tient to-do list. You can change the initial even-hour times on the schedule, so you can insert something every 10 minutes from warr. You enter the details of the appointments and the to-do items directly and get schedules for other days by seroling. A search feature lets you look for a key word or phrase.

Command Performance features a handy multiple-posting submenu. You need to enter recurring appointments only once. Conflicting appointments produce a warning on the screen.

You can easily print any screen to give a written record for use away from your desk. The program uses the personal planner files to search for meeting dates, but they are not available for viewing by other network users.

network users.

The personal telephone directory allows you to store up to 250 names, addresses, and phone numbers, along with remarks. You can retrieve any number by entering criteria that match the entry characteristics. The program dials out using a Hayes-compatible modern. You can also print the phone directory, which users do not share on the network.

The notepad lets you type notes and even reports up to seven pages long. Command Performance's editor is fairly sophisticated, including automatic word wrap, box drawing (useful for graphs), and cut and paste. You can save the notes as files and recover them by using the file-name or searching for a specific text string. You can also import and export ASCII files. As with the phone directory, network users do not share note files.

The calculator lets you perform simple, quick calculations, and the action items list keeps track of up to 15 critical tasks or projects. Also, the electronic mail system allows you to receive and send messages up to 18 lines long to any individual or group on the LAN.

MEETINGS SCHEDULER One of the more-interesting features of Command Performance is the meeting scheduler. The scheduler doesn't display available time, as that of Higgins does, nor does it actually find time for meetings, as 10NET's and other systems' schedulers do. Instead, if you have a time you want to hold a meeting, you propose the time and attendees to the program. The scheduler checks the personal planners of each attendee and reports who has conflicts. Then you either propose another time or call individuals to ask them to clear their schedules. If no conflicts exist, the scheduled meetings automatically appear on each user's personal planner schedule, along with a reminder in their electronic mailbox. The drawback of this approach is that trying to get busy people together without being able to view their individual schedules can be difficult.

The program lets you bypass commonly used DOS syntax by selecting the directory and files you want to work with and then choosing the DOS commands from The new Diconix 300 Desktop and 300w Wide-Carriage mistake them for Diconix 150s. Before you



plain paper printers. So quiet, so small, so fast, you could lecide on a PC printer, reflect on these.





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	ETH.	THE					
	ce: Mail LAN Package	Command Performance	CompareRite	The Coordinator	Direct Net	FerComment	Higgins
Number of authorized users	25	5	5	(LAN version)	Limited only by server	16 authors, unlimited reviewers	20
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—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable: product does not have this featu

is feature. "Prices are omitted because of the complexity of LAN pricing options

menus and submenus. A helpful directory tree appears on the screen when you select DOS functions.

Installing Command Performance is entaively straightforward, with co-3preleasively straightforward, with co-3prehensive screens and fields to help, but the network administrator must have a conserved and smouthedge of the networking software as well as DOS. Being able to create a given give in menu and copy it for each user, modifying it as necessary, is particularly may be a proposed to the contraction of the proposed o

Once installed, Command Performance is generally easy to use. The utilities are not memory resident, but that way they don't monopolize scarce workstation RAM when they're not in use.

Command Performance is a sensible jumping-off point for using a workstation. It's particularly good in helping new users find their way to selected programs while preserving security. The desktop accessories, particularly the e-mail system and the meeting scheduler, are handy, even

though no one feature particularly stands out compared with similar ones in competing standalone programs. The DOS menus are a good way to give users some system canabilities without vielding complete sys-

tem access.—Eric M. Cole CompareRite

Jurisoft calls its document comparison program, CompareRite (\$500 for up to five stations), an "instant redliner." Red-lining, used commonly in law firms on contracts and briefs, is the process by which someone underlines in red the changes in a document from one version to another, to draw attention to their differ-another, to draw attention to their differ-

CompareRite adds the speed of a computer to make the process "instant." In takes two drafts of a document and shows the differences between them, with certain initiations. Although the program was developed mainly with legal documents in mind, you can use it in other areas such as editing, management presentations, technical writing—anywhere that changes are

made in lengthy official documents.

The two text files that CompareRite compares must be either in the same word processing file format or be in ASCII format. You designate one file as the "old"



LANSaich	LANscape	Lanscope	Le Menu	Magic Henu	NETmanager	The Network Courier Inter-Network Version	Right Hand Man	Shoebax 3	Workstalion Wizard
100 per server	Limited only by server	Limited only by server	Limited only by server	Limited only by server	Limited only by server	100 (single- network version)	100 (RHM-100 version)	Limited only by server	Limited only by server
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N A 40K	Less than 1K 256K	15K N.A	1K 290K	17K 17K	30K 250K	54K 128K	46K 46K	198K 198K	3K 3K
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version and another file as the "new" version, and the program compares the two. The output of the program is a third file, with the differences between the two input files shown in one of several ways that you select.

You can put CompareRite to work on your files in either of two methods: the menu method or the direct method. In the menu method, a series of menus guides you through the choices. You use menus to designate the files (complete with pathnames) being compared. After the files are entered, you have a number of options as to how the additions and the deletions in the text appear in the output file. You need only select the default values to obtain a perfectly acceptable, even if somewhat staid, comparison. The default values show the changes as underlined and bracketed, but they may also be bold, struckthrough, italicized, or for that matter, almost anything that strikes your fancy. The

choice is up to you.

The other method of initiating the program, the direct method, is faster but gives considerably less scope to your artistic inclinations. You simply enter the document filenames after the DOS command prompt, and the program goes straight to work using the default commands to mark the changes. If you initiate CompareRite

The documentation writers are refreshingly candid in the 38-page manual, going to great lengths to point out what the customizing features of CompareRite cannot do.

with the direct method, you can include the program in batch files. This capability is particularly useful in a workgroup in which users develop documents interactively. PROBLEM FILES. The documentation writers are refreshingly candid in the 38page marual, going to great lengths to
point out what CompareRite cannot
to the customizing features of the program
ty to account for the difference in the files
created by various word processors, but
files that have had a lot of formating
changes may give you some erraits results.
CompareRite will also encounter problems
if a document has had entire paragraphs either added or delether added or delether
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CompareRite also comes with three additional pages of instruction for installing it on a LAN. You can install the program by using a special program that either allows you to use individual passwords to define separate files or uses a "next-available" method, by which all users access a single file and then wait their turn. The installation procedure is a straightforward as anything can be on a LAN, considering the issues of shared files and user privilees.

If you do a lot of document comparing or interactive document creation, CompareRite can be a useful group productivity tool.—Eric M. Cole





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nardware or software are, in reality, the fault of raw electricity. Industry statistics show that half the downtime, half the staggering costs of lost employee and machine productivity and half the maintenance costs are the direct

result of bad electricity.

A typical computer site experiences about 7 blackouts, over 500 sags and more than 2,000 spikes and surges per year. Plus there's almost continuous

more than 2,000 spikes and surges pe year. Plus there's almost continuous line noise at even the best locations. Power surges alone are credited by

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fraction of the total power output, you can't blame power companies for "formulating" electricity to run energyintensive industrial machinery, lighting and home appliances.



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The Coordinator

What do Frito-Lay, Du Pont, Baltimore's Sinai Hospital, and Novell have in common? They all use The Coordinator, a group productivity software package from Action Technologies, sold for \$2,495 for a LAN of up to 50 users. Marketed by Novell as an addition to its network operating systems. The Coordinator is one of the few programs developed specifically for group use on a network.

It would be too simplistic to call The Coordinator an electronic mail and personal calendar system. The package is based on research done by Action Technologies founder Fernando Flores on how computers can help an organization to accomplish its goals. His premise is that the members of a workgroup get things done through their involvement in networks of

"conversations." Each network of interrelated conversations may include requests and promises to fulfill commitments, specifying the conditions under which they're to be fulfilled, or just exploring various possibilities. As these networks become more complex, the task of tracking who does what becomes more difficult and reduces efficiency. Broken commitments are symptomatic of this problem, and implementing The Coordinator among a network of computers can help reduce them.

The program structures and automatically tracks all conversations, along with the commitments, proposals, and requests they contain. Individual users have reminder systems, managed by The Coordinator, to keep them on track with all their commitments.

THREE MANAGERS To accomplish its goals, The Coordinator has three main functional areas accessible from the main screen by menu commands. The Conversation Manager, the heart of the program, guides the user through the many conversational protocols. It presents a choice between two different types of conversations: those during which specific requests for action are made, to which the addressee responds with one or more commitments. and those during which more-general and more-speculative proposals are discussed. An example of the first type may be a situation in which you request a report from someone by a certain time and the person

agrees to deliver it when needed Through menu commands, the Conversation Manager also asks for the name of the department where the conversation is originating, persons to whom it should be addressed, and the time constraints on the actions proposed. After you've written a message with the built-in word processor. you can speedily route it to its destination. The program will store the message for future reference by all concerned parties.

With the Scheduline Manager, shortterm calendars show appointments and commitments on a daily and weekly basis. You can enter these commitments manually, or they may be automatically generated from conversations. In addition, you can generate long-term calendars for longerrange planning and commitments.

Working closely with the Conversation Manager, the program's Connectivity Manager routes e-mail and sends it with a minimum of effort among the stations. Since you can call all this information from menu windows, sending a message, even a binary file, is fast and almost automatic. A mail-waiting signal on the screen tells you

whether you have any messages.

The Coordinator also has optional facilities to communicate across voice-grade phone lines either to other networks or to standalone stations. A network can have as many as 10,000 stations, substantially eliminating the need for regular phone calls, paper memos, letters, and many meetings.

EASY TO INSTALL AND LEARN We installed the program on a Novell network running under the SFT NetWare 2.1 operating system and using Action Technologies' recommended installation process. Keep in mind that The Coordinator is a real memory hog, requiring 640K RAM. We resolved compatibility problems by manually altering some of the group access permissions and file designations. There's a comprehensive installation manual, as well as a demo and tutorials, and the actual installation is a simple matter of copying the six program disks onto the server's hard disk

The Coordinator is easy to learn but tougher to master. The context-sensitive help is generally useful although a bit wordy. Windows offer extensive menu choices

INCITING INSURGENCE? Managers will welcome the program's ability to easily trace a project's history. It automatically keeps track of all proposals, requests. commitments, and agreements and recalls them using various criteria such as project name or date. Individuals can keep track of their commitments, as well as those made to them by others, thus adding to the efficiency of the group.

Not everyone will feel comfortable with the various kinds of conversations and the rigid electronics demands. Most of the organizations that we talked to, however, were enthusiastic about the program and reported only a few holdouts-users who refused to use the conversational categories correctly.

If you have visions of paperless offices dancing before your eyes and are interested in getting LAN users to work together more efficiently, take a look at The Coordinator. You need group consensus to make it work, but increased group productivity can be your reward.-Eric M. Cole





List Price: For a LAN of up to 50 users, \$2,495; \$1,995 to expand to 51-100 users. Telecommunications Manager (to connect to remote networks and standa Jones), \$995 Requires: 640K RAM. Novell's Advanced NetWare (Version 1.02 or later) or LAN on erating system that fully supports DOS 3.1 or

In Short: This well-thought-out program is a virtual expert system for managing communications and eliminating a lot of paper shuffling. It imposes rigid demands for electrontes as well as on criteria for the types of conversations it manages, and it's easy to learn but tougher to master. Not copy pro-

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Direct Net

Direct Net. priced at \$24\$ from Delta to Technology International, boast a number of features for both network users and unanagers—and what it does, it does well. If all you want is to get to network applications without a tisse, it may be the ticket. But if DOS shells have spoiled you and to you want macros, aliases, or DOS command access from within applications, the noveram will disanomint you.

A network shell, Direct Net provides a more or less painless interface between user and network. Licensed for use on a single file server, the program is usually installed in a public directory on a network drive. You can also install it on a standalone PC, but the files must be put on a hard disk drive, since, when installed, they won't fit on a loopy disk drive.

For network users, Direct Net is a menu-driven system, you step through the menus to select an application. Where a program resides is irrelevant—tim by be a multiuser database system residing on a multiuser database system residing on a network server or a word processing package on your own workstation. Direct Net segments of fortless.

Direct Net begins by optionally

prompting each user for a user name and project number, both of which it needs to compile usage statistics for the network. Then Direct Net presents its menus.

The menu structure has two levels. The main menu, the highest level, shows 20 user-definable items displayed on two pages listing 10 items each. To switch between the pages, you use the PgUp and PeDn keys. Main menu items list general categories of programs, such as word processing or communications. A user or network manager defines each category. which appears next to a letter on the screen. To select an option, you press its corresponding letter. (After reviewing several of these programs, we appreciated the ability to select options with a single keystroke rather than having to move a highlighted bar around a couple pages of menus.)

Choosing a main menu category brings a submenu onto the screen. Submenus work similarly to the main menu, with letters defining up to 20 applications within





Direct Net
Delta Technology
International Inc.
P.O. Box 1104
Eau Claire, WI 54702
(715) 832-7575
List Price: \$245

Requires: 256K RAM (S84K required to print usage reports); DOS 2.0 or later. In Short: This program offers an easy but slow way to get around your network with menus. Although it monitors user activity, it lacks other features, such as macros. Not copy protected.

one main-menu category. Anyone with menu maintenance privileges can alter the wording or the sequence of main menu and submenu displays, or assign passwords to menu selections. Passwords restrict access from the main menu into a submenu, or from a submenu into an application.

Submenu entries require the application program name (for example, Losts 12-3), the drive and the directory where the program resides, and the command (such as 123) that you would type at a DOS prompt to start the program. The only exception is a batch file: to execute a batch file through a Direct Net ment entry, you must precede the name of the batch file with the word "Batch".

You can customize menu entries by using the symbols for question mark (?), comma (,), and ampersand (&). The question mark tells Direct Net to prompt for a password specified during menu creation or maintenance. A comma in a menu entry causes Direct Net to prompt for a floopy disk. And an ampersand cues Direct Net to prompt for additional parameters. You can combine all three special menu symbols on one line if they are in this order: ampersand, question mark, comma. A Custom Application, Direct Net's equivalent of a DOS batch file, can use the same symbols. A user can log out by pressing the F5 key. At that point, Direct Net executes a

batch file named LOGOFF.BAT, which
you can configure to suit your own needs.

Direct Net's menuing system works

well but is very slow. Starting the program on an IBM PC-XT with a 20MB hard disk drive took 22 seconds. In addition, these 22 seconds were filled with an alarming amount of hard disk activity. On a network, all this activity adds to the network overhead. Switching between applications takes considerably less time, but the menus make changing applications tiresome.

PLUS FOR NETWORK MANAGERS

Network managers may like Direct Ner because it includes tools that compile and print (or display) reports of user activity. The program can sort these reports by user names, project numbers, application programs, specific workstations, and, of course, by date and time. Detailed reports contain particulars on all the sort fields, and the network's general usage and workly totals amone on summary report on summary contain particulars.

Direct Net maintains network statistics by requiring users to log in before it presents the main menu. As soon as a user logs in, Direct Net starts keeping records of the user's activity, continuing until the user lors out.

Unfortunately, Direct Net's version of Big Brother is not 'very so phisticated. While it prompts users to enter a user name and/or project number, it accepts anything (except blanks) in these Fleids. Most system of the property of the pro

Once you're ready to look at the network reports, Direct Net gives you a choice of sending them to the screen or to a printer. And through the report generator, you can specify commands to execute before and after printing. These commands allow you to set up the printer for compressed type, for example, and reset it afterwards.

You can delete all the data from the network usage log at will. You can also delete selectively—by project number, user name, application program, or date. Installing *Direct Net* requires strict at-

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tention to access rights. The program assumes if a program or a file is in a submenu definition, the user has full read/writectracate access to it. This may or may not be the case, especially in database applications. When sorting a network usage report, Direct Net creates temporary files and assumes users of this feature have read/ writectreate privileges in the subdirectory where they are created.

Overall, Direct Net is a convenient though slow way to access your network. For people who just want to get on with their work and don't care to learn how the network operates, it can be a reab boon. And it's easy to get up and running if you properly arrange the access rights.

—Frank J. Derfler, Jr., and Tom Wisniewski

ForComment

Although Broderbund Software is known mainly for its entertainment and home education programs like Where in the World Is Carmen Studiege? and The Prints Mery of the Prints Prints Programs for Southern to excure the Software Southern to the Software Southern to expense tempt to reach out to the LAN-oriented tempt to reach out to the LAN-oriented poyung et comments on your documents from Your documents from Your Software So

If you've been frustrated by responses from people you've saked to review documents—"I must have put it somewhere" or "Gee. I sent it back to you. It must have gotten lost "—with For Comment installed on your LAN you'll know immediately where your document is, what comments your reviewers have, and who made the comments. Plus For Comment allows the reviewers to comment on your documents without messing them up.

We've reviewed ForComment before ("Editing by Committee," PC Magazine, March 31, 1987), mainly as a standalone program. But its powers really come together on a LAN, where individuals can quickly access files and offer comments without the overhead of disk swapping.

HOW IT WORKS The person initiating the review process is the only one who can alter the original. That person, called "the



author" by ForComment even though he or she is not necessarily the actual writer, uses a special program in the ForComment package. Using that program, the author first imports the document to be reviewed, either from a word processor or from For-Comment's own memo writer. On the "cover sheet" screen, the author first fills in the names of the people who will review the document and assigns initials and passwords. The author can then add some comments, load the document back onto the server's hard disk, and inform the reviewers by e-mail that the document is ready for review. If the author doesn't want the reviewers to see each other's comments and suggestions, then each reviewer must have a separate copy of the document on the server.

Reviewers select the ForComment reviewing program, choose Review from the menu, and sign themselves in on the cover sheet. The program screen has two windows; the upper window contains the document under review, and the lower displays the comments and suggested revisions. ForComment refers each comment or revision to a line in the document, and it adds the reviewer's initials automatically. Although reviewers can only sag-

gest changes and cannot alter the original document, they can view their suggested revisions in context by temporarily "swapping" the revision with the original.

The author can then view the comments and suggested revisions. If these comments have been much share been much share been much share been untents for each reviewer, the author can either use them individually or collate them. The cover sheet indicates which reviewers had something to say about the document. If the author approves of the suggested ideas, ForComment enters them into the original. You can repeat the review process as many times as necessary.

You can print the document from the program or convert it back to a word processing file. If you like, you can print the document with each line numbered and with comments and revisions as either footnotes or endnotes.

EASY TO INSTALL AND USE Installing ForComment on a LAN is a straightforward process. Most users should find the appendix in the manual covering network installation to be an adequate guide. But the person installing ForComment, preferably the system administrator, should have a knowledge of the software used on the LAN as well as a facility with DOS and the directories available on the LAN server. For instance, so that reviewers do not have access to the author program, it should be in a nonpublic directory. A network administrator might link a specified drive to the ForComment files to make operation easier for first-time authors and reviewers.

Its good menus and context-sensitive help screens make ForComment easy to learn and use—important since few people will use the program every day, and learning time should not outweigh use time. The main manual is comprehensive and well thought out, and condensed manuals are available for individual users.

Demonstration and tutorial files, provided on a separate disk, are a useful introduction to the program. However, since you cannot load them onto a hard disk, they are relatively slow and, more important, are not directly available to users on a LAN, especially one with diskless workstations.

Some of ForComment's procedures are



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much more efficient on a LAN as compared with on a standalone PC. For example, you don't seed to distribute disks, physically on the reviewer, and you don't reviewer's comments. If you need a controlled way to solicit comments and suggestions about documents and sugpositions about documents and sugrestions. The seed of the seed of the reviewer's comment on a LAN, It's fast, easy, and efficient—Feed No.

Higgins

Conetic Systems claims there's an easier way to get a number of busy executives together than playing telephone tag: Higgins, which retails for \$995 (the Higgins LAN Server Kit for up to 20 users).

Higgins lets you retrieve documents and memos using short keywords. You can also exchange information with anyone on the network if you are so autho-

rized. The pop-up functions include a calculator, notepad, timer, clock, and reminder similar to those of other desktop accessory programs but tied in with some of *Higghis* other functions. The communications system handles not only electronic mail within the LAN but—when combined with the program called *Higgins Ex*change—also establishes links with other networks.

SCHEDULING Higgins' scheduling functions give you the main screen and menu selections from which you summon all other administrative operations. When you boot up Higgins, the calendar and schedule bar graph appear first, along with menu selections.

You review and enter schedule details through the Appointment Log menu selection, which in turn gives you access to other menu commands you use. You can enter more details about these commands through a screen that displays more-specifie data about appointments. You can also index these notes to keywords and recall them later.

With everyone's schedule available to authorized users, it's easier to schedule meetings. One person chooses a time and e-mails it for confirmation to participants after viewing all their schedules. Reviewing the calendars, however, is a





Higgins, Version 2.2 Conetic Systems Inc. 1470 Doolntle Dr. San Leandro, CA 94577 (415) 430-8875 List Price: Higgins LAV Server Rat for up to 20 users (includes Huggins).

Systems Administrator Manual, and User Manuals), 5995; Expansion Kit for unlimited number of users on same LAN, 5995, Higgine Eurhange thandles up to seven servers), \$1,595; Demonstration Package (for standalone PC or a network), \$49,95

Requires: For server's program area, 1,200K RAM: plus 400K for each user and 200K for the mail system; IBM, Novell, 3Com, or any DOS 3.1–compatible network Workstanors, 320K RAM.

Workstanen, 200k RAM.
In Short: This comprehensive, wellthought-or program includes such features are scheduling, a derrowy, a two-fix season and expense reporting. Hagging consists of memory-prodent modules designed to a good and only produced modules designed to a good engenium memora. Expectally with its exceptional emulation. Expectally with the expection of any LAN workgroup. Copy protected. OCCL 188/2016. USESTRANCE ONC.

manual process. Unlike Shoebox 3 or the excellent scheduling system found in 10NET, Higgins offers no automated help in finding meeting times.

OTHER MODULES Invoked from the main calends recrea, a letphone directory records such information as names, companies, and phone numbers. More tails are available from a second directory screen, which, like the appointment log window, can consist of both standard entries for biographical details and a provision for a free-form note. The directory is linked with a dialer for Hayes-computible moderns.

Selecting the To-Do command on the Calendar screen invokes a list of issues requiring attention. You can assign them a priority status, due date, project reference, and description, and you can add details on a secondary screen. Higgins also can help you to track expenses and fill out expense

One of the program's major strengths is its powerful e-mail delivery system. You can send a memo to any number of individuals, with exclusives like other documents with exclusives like other documents you desire. Higgins efficiently notifies the addressee when an urgent memo arrives. In addition, the optional program Higgins Exchange links the file servers of up to five other LANS.

INSTALIATION Higgins is installed only on the robox enercy sixed in stalled inself in the workstation's RAM each time it is called. Several modifications to the basic installation, however, may be needed, depending on your requirements. Each user who requires access to files other than iso own will need a special path installed. The system administrator must have a good knowledge of DOS—including drive good knowledge of DOS—including drive modification of the proposal control of th

Documentation includes a comprehensive manual with a good reference section, lots of screen pictures, a glossary, and an index. There's more: three tutorial sessions that deal with different Higgins func-

Despite its complexity, Higgins is easy to use. Menu instructions are clear and logical, and the 1-2-3-like use of either initials or highlighting to enter them is handy—although using the Spacebar to point to menu items (with cursor arrows reserved for the main screen is confusing.

In general, the program is well thought out and potentially useful. It adds considerably to the features normally associated with both networking software and desktop accessories. In the long run, how useful Higgins can be depends on how much work the group puts into keeping it current.—Eric M. Cole

LANBatch

LANBatch, from KeyLogic, priced at \$125 for the single server or \$325 for the multiple batch server, offers an interesting and potentially important service to users of Novell's NetWare. It allows anyone on the network to send work to a dedicated machine for processing and to tell another workstation to do some type of process or

No matter which of these modes you use,

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400 for text, and 640 x 480 in 256 colors for graphics. Both displays have a 14" CRT, versus the 12" industry standard. And both come with a built-in till/swivel base and are backed by a 2-year limited

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group of processes. Thus, it frees up the user's workstation for other tasks.

and output, LANBarch's reasonable price and

its power make it a practical and useful tool

for Novell's Advanced NetWare-based

LANs Not copy protected.

ORCLE 679 ON READER SERVICE CARE

user's workstation for other tasks. LANBatch, which comes on two disks (system and backup) and has a 70-page manual, allows practical sharing of resources and works like a service that was once available only on large-scale was frame systems like IBM's VM and VSE. Any process that can run alone can run the remote LANBatch processor. You can use a LANBatch processor. You can link program code or to generate graphic images and sent them to a laser printer images and sent them to a laser printer images and sent them to a laser printer.

and the state of t

LANBatch, which runs on a networked PC and needs no special hardware, does an excellent job of bringing the capability of batch mode processing to a LAN. Since the batch server software resides in a public directory, any machine not in use can become a batch server. You determine at boot-up if the machine will act as a batch server. In theory, one of the faster machines on the network normally would perform this function—a good way to share the power of 80386-based PCs.

Many LANBatch features rival those of mainframe systems, including the ability to notify the user at completion time or if an error is detected, priority-controlled job execution, queue retention after shutdown, and a complete queue management system.

LANBatch's unique WaitFor utility improves the flexibility of the batch server. It allows you to tell a job to interrupt and wait for other users to complete their tasks before continuing.

LIMITATIONS The two limitations we found were in input and output. Although LANBatch cannot run an interactive job or one that requires console input, you can use DOS redirection to specify input. For example, the command

BATCH "GENREPT < H:\86FIG\86TOTALS.DAT"

supplies the program GENRPT with input from the 86TOTALS.DAT file when the GENRPT program asks the absent user for a filename.

If your application program has its own program code (or macro language), you may be able to write applications that can run alone on the LANBatch processor. For example, the programming language in Crosstalk Mk.4 allows it to perform sophisticated tasks alone on a LANBatch server without tying up your workstation.

In addition, since LANBatch does not automatically handle output, you must specify the name and the location of output files in the application or through DOS. You can redirect the output from the program with a simple DOS redirection command and examine it later. The command

BATCH "DIR /W > OUTPUT"

sends the command DIR/W to the batch processor and the results of that command into the file, Output. (The quotation marks are necessary so that the output from the Batch command doesn't go to the Output file.)

NETWORKING For LAVBach to run on the network, he network administrator must create a user ID called Batch. This ID is treated just like any other user ID, and it is subject to access rights and restrictions. The software will run outly on a machine that is logged on as Batch. You must give the Batch user ID enough rights to access any of the directories and the peripherals. By doing so, you also give anyone using this system the same access as the Batch

user has. If security is not a big concern, the best thing to do is assign supervisor rights to the Bachtuser. Under NetWare, you could use the SysCon facility to create a special group defining the people who can use Batch. When the batch server processes a good of the security of the person who submitted the file as the current directory, but the security of the person who submitted the file as the current directory may be secured the security of the person who submitted the file as the current directory. The cases and the security of the person who submitted further directory. The cessary, you may specify another directory when the batch request is made.

Version 2.0 adds features like time and date control, advanced queue control, and daily repeat jobs. A version that supports multiple batch servers on the same network is also available. LANBanch's modest price and powerful features make it both practical and useful for Novell Advanced NetWare LANs.—Frank J. Perfler, Ir., and Edwart Halbert

LANscape

If keeping track of files gives you a headache, take a look at LANscape, \$995 from Ncompass. LANscape is your LAN's librarian: a complete system that takes just 5 minutes to install and includes all the tools your LAN—from catalogine to backup

and archiving.

LANscape manages your data, including word processing, spreadsheet, and dabase files—files that need description.
The program gives you 27 characters to
describe the files. It doesn't manage application programs with COM or. EXE extensions, though—just the data files they
create.

SURVEYING LANSCAPE To create a data file in LANscape, select Create from its main menu and fill in the template displayed. The template stores information such as directory and pub statements, but the program fills out most of the template from stored information. You supply a profile of the work you typically do in an ID catalog. LANCacpe links this information to your author ID (typically your initials). Then, when you're confined by a template, the program can complete most of it for you.

on it tor you.

The ID catalog keeps lists of choices for each field; when in doubt, type something, and LANscape will display the catalog entry closest to what you typed. You can also use PgUp and PgDn to see the other

choices.
These features, however, are available throughout LANscape, not just while creating files. You can see the active keys at the bottom of the screen in the control panel, which describes key functions and also

supplies on-line help. When LANGacope passes control to the parent program, it becomes idle until you exit the parent program, it becomes idle until you over the parent program. While side, LAN-scope uses as few as 100 bytes. And when you quit your program, LANGacope saves your data under its internally generated DOS filename. LANGacop updates its catalogs with your title and other data from the template, including the filename under

which you saved the data. The program then becomes active again and returns you to its main menu.

To find files, LANscape searches its catalog (not the disk directory) using one or more specified template fields. Once

LANscape is your LAN's librarian: a complete system that takes 5 minutes to install and includes all the tools you need to manage the

program files on your LAN from cataloging to archiving.

.

LANscape locates the data file, you gain the ability to use it with its parent program, move it, or copy it.

LANscape's system of titles linked to internally generated filenames makes the program easy to use. But if you somehow destroy the catalog, you'll have to go through all of LANscape's DOS filenames to recover your data files. A suggestion: back up your data and the catalog often.

UTILITIES MENU When choosing the parent programs you want LAViscope to use from the utilities menu, you either succeeding the programs from a list of preconflict interfaces supplied with LAViscope, or developed the confidence of the programs interfaces are developed programs interfaces as the total Ware's PC-Type, PC-Cale, and PC-File. Necompass ships these shareware programs with LAViscope, which installs them automatically when you select them from the interface menu. Toggether they offer the programs of the processor, the programs of the processor of the pro

While you can add programs not on the preconfigured list of interfaces with LANscape's generic interface utility, note that LANscape doesn't regulate multiuser issues for you. You'll want to keep singleuser programs and their files in limited-access subdirectories, since LANscape assumes you have access to any subdirectory you want to look at.

For boilerplate text, you can create a document shell with your parent program and store it in LANscape. When LANscape starts your application, it reads the shell into your data file. And when you no longer need files, LANscape helps move them off the LAN by archiving them.

If you're running out of descriptive amens for your data files or if you've got a lot of different people working on documents, LMNcape can give you the flexibility to sort things out. In return for the little work necessary to complete templates, this easy-to-use tool overcomes a limitation of DOS and makes it work for your organization—not against it.—Tom Wisniewskil

Lanscope

Lanscope, from Connect Computer (server license, 5799 per server; eight-user license, 5499 per server), is a utility that remembers everything about the LAN so that the administrator doesn't have to. Better yet, it often intervenes and configures common applications for specific worksta-

tions.

The heart of Lanscope is a database management system (DBMS), You have to enter a loof data into the DBMS, but in the ne helps with network and user activity persors, resource management, software propers, resource management, software menu systems. Also included are several bodget permitted and stay-resident (TSR) utilities for printer spooding and setup-from control, screen saver, terminal key-boards/screen lock, and local/network activity logging.

THE RIGHT STUFF One of the Lanscope's more-impressive features is its ability to ensure that the correct version of an application program, with the proper corresponding driver sets, runs for each user in accordance with the workstation's configuration and the user's privileges.

Suppose, for example, that a workstation's video monitor is upgraded from a monochrome to an RGB monitor. After changing the hardware and performing any setup routines unique to the computer,



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GATEWAYS TO DYNAMIC NETWORKING

Tiled windows and menu structures are chief among the interfaces designed to help network users realize the full potential of network interaction.



After you enter your name and project number, Direct Net's main menu displays up to 20 categories of programs; 3 are shown here. When you press an appropriate letter, the corresponding submenu offers up to 20 applications.



LANscape is preconfigured for a number of application programs; 25 are shown here, along with a graphic depiction of the keystroke options. To add a parent program that isn't on the list, use LANscape's generic interface program.



NETmanager's most interesting feature is remote control of a workstation. From the Active Call Menu, you can examine user and equipment data, display statistics, and reboot the remote PC.



tiled window interface. Several of these applications allow common data files (like lists of names and telephone numbers) to be shared among network users simultaneously.





Requires: For Lanscope workstations, 648: RAM, a network serface card, the network software shell or redurector, DOS 3.x. in Short: A "network amanger's assistant" based on a database management program, the program reference the data that you enter to configure and regulate application programs. It also generates various susque reports and contains some network untillus for print control. Lanscopies in complex and cumbers some to so tap, but worth the effort. Not copy and contains the control Lanscopies in complex and cumbers some to so tap, but worth the effort. Not copy and contains a some to see the programment of the control Lanscopies in the control Lans

you make the appropriate changes in Larscope's database. Then, when someone at the workstation calls an application like Lotus 1-2-3, Lanscope checks its database and makes the right video drivers available. This capability saves having to define different driver sets and batch files for each application running on a workstation with a different configuration.

with a universe congunation."

Lancage uses a time pair of 3 Com's a Lancage uses a time pair of 3 Com's 3 + Share and Banyan Systems. While 3 + Share and Banyan Systems While 5 to the nework operating systems. The first part of the name is the actual user name; the second, the group name; the third, the organizational name. Besides giving individual users unique IDs and grouping them logically, this convention tracks network tracks network the state of the system of the state of the system of the state of the system's showing how much memory acceptance and which resources are used by a consideration of the system's resources.

Another benefit of this kind of resource tracking is that by knowing the characterisatics of the users, the network manager can be on guard against overloaded resources. Lanscope's reports help both in rearranging files and equipment to meet demand

and in justifying new purchases.

The Lanscope report generator maintains information about network usage, activity, and security Lanscope reports include audit trails, network change logs, user summaries, application summaries, resource usage, and security implementation/changes.

ONE MENU Lanscope's user/workstation menu system integrates both local and network workstation menus into one comprehensive user menu. A library/database of menu templates manages it.

Lanscope's menu template editor creates and modifies how a menu looks, which options are presented, and which batch file commands are necessary to execute the option. Once defined, this template can be assigned to a specific user or group of users with identical needs and privileges.

Commands in the menu batch files include standard DSG internal and caternal commands plus Lanscope's own array of commands. In escence, the program furnishes the network manager with a promate of the commands are if in the commands are and dynamic workstation menus. Among the commands are if in the commands are debugger, and I/O capabilities. All these commands allow the flexibility of creating menus for a large number of users with difteres, and media.

With the program's Universal Information database-wherein each user, workstation, server, volume, application software, printer, and communication device(s) are defined-users can be grouped into logical units that share particular characteristics. All users in the Accounting Unit, for example, can use the same menu template, a feature that climinates the need to change each user's menu individually when changes occur. A powerful feature of this menu system is that during use, the specific network resources are checked against the user's privileges. If a user is not authorized for a certain resource, that resource does not appear on the user's menu-even though it may be on the menu template assigned.

Overall, Lanscope's major drawback is its complexity. The network manager

must have some programming experience, especially in learning a new language. But Lanscope does reduce the risk of system obsolescence, since it has a means to cope with changes. Another drawback is the need for discipline. Like any DBMS application, you have to put the information in right and keep it current. If you don't tell Lanscope what's new, it doesn't know what to do.

Lanscope offers what most network operating systems lack in terms of user, workstation, and resource management tools. The program can be cumbersome to set up and maintain, but for medium-tolarge installations, it's worth the effort.—Roberto Rivera

Le Menu

The French might shudder at its name, but Let Menu is a menuing system from Bartel Software that comes in single-user (579-95), multiuser (599-95), and network versions (523-95) per file server). Advertised as a hard disk manager, Let Menu is really a comfortable interface between you and your computer, combining a DOS shell and a menu-creation system.

Network administrators may find the menu-creation capability useful if they lack it in their network operating systems. The multiuser version of *Le Menu* adds se-



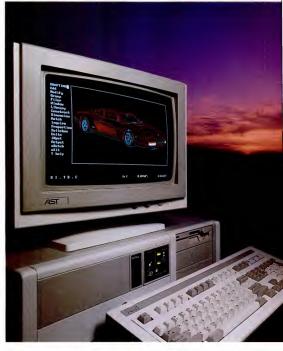


Le Menu, Nctwork Version 3. t Bartel Software Inc. 942 East 7145 So., #A-101 Midvale, UT 84047 (801) 566-5544

List Price: Single user, \$79.95; multiuser, \$99.95; network, \$259.95 per file server. Requires: 320K RAM, any NetBIOS-com-

patible LAN, DOS 3.0 or liner. Hard disk recommended. In Short: This complete menuing system, which includes DOS commands and directory maintenance, is fast, easy, and generally offer. Which he sales.

mifty. White the single-user versions really shine, the network version isn't as impressive. Not copy protected. OROLE 676 ON PEADER SERVICE CARD



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curity (password access) and some primitive usage-tracking functions.

DOS SHELL Le Menu supplies all the familiar DOS functions in its DOS function screen, reached by pressing F1. You make your choice by moving the highlighted bar and pressing Enter. To get right to a service, you press the bracketed letter displayed in each selection.

Le Menu uses DOS to do its work. Earlier versions copied your DOS files into the LEMENU subdirectory so it could use

In essence, Le Menu is a comfortable interface between you and your computer. combining a DOS shell and a menu-creation system.

them. Beginning with Version 3.0, you can keep the DOS files wherever you want. You use the DOS SET command to point Le Menu toward them

If you press F2 from either the main menu or the DOS function screen, the program immediately displays its Directory Management screen. The screen begins by showing you a directory tree. Le Menu also displays disk statistics, such as the amount of free space available.

Le Menu doesn't generate the directory tree each time you ask for it. Instead, the program keeps a copy of the tree in a file on disk. If you exit to DOS and remove a subdirectory. Le Menu won't notice (not a problem as long as you stay within the confines of Le Menu, since you can easily remove a subdirectory using the Directory Management screen).

When you choose a DOS subdirectory from the menu, Le Menu shows you the files in that subdirectory-along with more statistics, including the size of the subdirectory and how many files it contains. If a file is executable, Le Menu detects that fact; you then have the option of pressing Enter while the file is highlighted | take while defining a menu. Le Menu | iting to DOS.

to load and start it. Le Menu prompts you for the command-line parameters

Le Menu can sort the files in the directory by name, extension, date, or size. You can limit the files shown by using wildcards in the search filename. If you actually want to examine a file, Le Menu is able to display it for you.

To encrypt your files from the Directory Management window, you simply press N (for eNcrypt). You can specify a key up to 12 characters long. Encryption works equally well on text and binary files. Recovery (if you have the key) is foolproof.

MENUS Le Menu gives you a main menu and up to five levels of submenus. All these menus hold a maximum of 26 entries, with every entry corresponding to a letter of the alphabet. When you press the letter of the option you want. Le Menu takes you there.

You need not define the menu letters in alphabetical order, you can even skip letters. When Le Menu puts the menu on the screen, it displays only the letters you have defined, in alphabetical order. This flexibility lets you choose letters as mnemonics, making selections easy to rememher-all the way through the submenus.

To set up a main menu entry, press F4 to bring the setup menu onto the screen. Le Menu prompts you to enter the letter you wish to define. If the letter is already in use, Le Menu displays the current definition; this makes changing existing entries simple. If the letter you pick is not in use. you enter a description of the selection. and Le Menu displays this description beside the letter on the menu. Optionally, you can pick a password to protect the new menu entry.

Next, you tell Le Menu whether this entry describes a submenu, a batch file, or a program. If the entry describes a submenu, you must fill in at least one option on the submenu. If the menu entry describes a batch or executable file, you indicate the drive and directory where the program resides and its filename. While you're entering this data, Le Menu checks that the drive is available. It also makes sure that the subdirectory exists and the file resides in that

subdirectory. it's almost impossible to make a mis-

watches you every step of the way. If you enter an illegal value, Le Menu lets you go back and correct it or get the correct infor-

mation from Directory Management. As previously mentioned, Le Menu allows you to protect individual menu entries with passwords. The program also lets you protect entire menus by specifying a password at installation. You can also specify a password that will stop an unauthorized user from exiting to DOS.

LAN USE. The multiuser version of Le Menu requires you to log in. Whoever installs Le Menu sets up the original list of users. Later, anyone with appropriate privileges can go to the DOS function window and add or delete users at will.

For usage tracking, the network version of Le Menu needs read, write, and create access in the subdirectory where it resides. This requirement, combined with the need to get to programs in other directories (with different access rights), can cause you problems. Le Menu's usage tracking is painless, but like all such schemes, to work effectively it requires users to log in and out.

Overall, Le Menu is a nifty program: it's respectably fast and almost eliminates the need to know anything about DOS. For the single user, Le Menu is super. Although the network version works okay, it sometimes causes headaches because of the access rights it needs. You might be better off buying copies of the single-user version and installing them on your workstations.-Tom Wisniewski

Magic Menu

As your LAN grows, so does the administrator's need to help users along and keep tight control of activities. Magic Menu. from Deere Soft (\$199 for multiuser version), is an easy-to-use menu system that enables you to create up to 127 menus for a variety of functions.

With an editor for the menus and a configuration program for the menu system, this utility also offers a restriction option that requires users to log separately into both the menu system and the network. Once inside the menu system, for instance, a particular user carrier restricted from ex-

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While the standard version of the program will run with any DOS-based LAN program, such as IBM's PE C LAN or 10NET, the version we evaluated had an option for Novel NetWare compatibility. This version looks for the Novell Shell each time the program is invoked and operates only under Advanced NetWare. Version 2.0A or later.

The puzzling question here is why Deers Solt is marketing a menu package for Novell networks; Novell, after all, already includes a good networking utility in NetWare. The best explanation of this may be that Mage them provides more control than the Novell utility and is less complex. In Novell's favor, its utility allows more flexibility in designing eye-appealing menus.

LOGICAL DESIGN Magic Menu is easy to use—if you have a logical mind. If you don't, you'll need to use printeds to keep don't, you'll need to use printeds to keep since you can create up to 127 menus with the program, you'll have to know a menu's specific number to get to it. Through the editor, MAGICMED.EXE, you can print an index of menus or the menus themselves.

Using this editor, you determine the width (40- or 80-column) and content of the menus. The maximum number of en-

tries allowed on one menu is 20, and you can modify and shuffle the entries so the most commonly used ones are on too.

The menus are no artistic achievement. They're simple-looking, with a title, an optional date and time display, and the number of the menu shown in the lower-right corner. With the configuration program MAGIGFIG.COM, you can change the menus' universal parameters. The most useful of these determines whether to allow single-key entry of menu options or to require longer character string.

INSTALLATION. OPTIONS The Magice Menu Install program is, of course, menu driven, It places the .EXE and .COM files in the root directory and creates a subdirectory, WAAGICM, for the support data files, namely the menu files and the control log files. The installation program lets you select the right video driver and adds the ANSLSYS driver to your CONPIG-SYS file if it is via thready for the control of the control of

The program's log-in restriction option serves as another layer of network security. With this option, you must log into the menu system and then take another step to log in to the network. MAGICUSR.COM builds and maintains the files of users and their passwords. This same option can refuse to let users out of menus you create with Magic Menu—which is useful if they shouldn't (for whatever reason) ever be allowed to see a DOS prompt.

Magic Menu lets you make good, though not spectacular, menus. In some applications, it's probably as useful for what it won't let users do as for what it helps them to do.—Frank J. Derfler, Jr., and Richard Hubbard

TOT

NETmanager Brightwork Software's NETmanager

makes the fantasy of remote control of your LAN a reality—at a price of \$1,495. The program enables you to set up a help desk from your own PC and assist others on the LAN without leaving your desk.

on the LAN without leaving your desk.
Allowing you to do remittely just about
anything you can do locally and to keep
track of LAN equipment and software,



NETmanager works under Novell's Advanced Netware 2.0a or 2.1, IBM's PC Local Area Network Program, Ungermann-Bass's NetlOne, 3Com's 3+Share, and AT&T's StarLAN. We also ran NETmanager on Banyan's VINES (with Net-BIOS services installed), with pood per StarLAN.

well-behaved application programs. Not copy protected.

CLE 674 ON REA

sults.

Brightwork ships NETmanager on two
5½-inch floppy disks. One holds a version
of NETmanager designed specifically for
Novell networks. The other contains a version for the NetBIOS-compatible networks listed above. The Novell version
works directly with the ANET workstation
shell module, while the NetBIOS-compatible version requires you to load NetBIOS
before invoking NETmanager.

The first of the two programs in the package, NRLISTEN, is a terminate-and-stay-resident (TSR) program. Since NRLISTEN must run or each of the network workstations you want to control, you keep it on a network file server. NRLISTEN uses between 9K and 31K. RAM, depending on how you configure it, and network users can enable or disable it at will.

The second program is the NETmanager program itself, called up via the command NETMAN. The list price of \$1,495 licenses a single usage of NETmanager and allows centacting an unlimited number of users from a single help desk. The program uses about 250K RAM, and

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HAYES COMPATIBILITY AND OTHER MODEM MYTHS.

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Modems that didn't deliver the full functionality of software packages.

Modems whose technical support ranged from indifferent to incompetent.

It's no news that manufacturing shortcuts and diminished levels of customer service can lower prices. But Hayes our efforts have always gone, and will always go, toward making modems that are better. Not cheaper.



Brightwork recommends a minimum of 512K RAM.

If you are using the NetBIOS version of NETmanager, the first thing that you must do is define. "listen names," unique combinations of up to 16 alphanumeric characters that identify PCs across the network. You assign a listen name to each PC who you start NRLISTEN. (In the Novell version of the program, however, NETmanager uses the server's log-in names as lis-

ten names.)

**METmanager has a user database available at all times. User database records are all times. User database records are tike index cards about each user, they list the equipment installed in or attached to each remote PC and refresh your memory about which applications a user commonly urns. In the NeBIJOS version, the user database also keeps track of listen names.

NETmanager stores user database records (but not the database index file) in dBASE Iff life format. Using the program, you can add, modify, or delete database records. You can also alter the database using dBASE Iff (if you do so, you'll want to use NETmanager's reindex function afterward, to sort out the index file).

CONTROLLING ANOTHER PC When you select Control Another PC from the main menu of NETmanager's NetBIOS version, the program gives you a list of listen names from the user database. You can pitch to the total program if you haven't added it to the user database.

The Novell version of NETmanager, on the other hand, shows you the users currently logged onto the default server (it uses the GUEST log-in name to get this information). You simply select the PC you want to call and let NETmanager do the rest.

If your Novell network has multiple servers, you can press the Spacebar to see the list of users on the next server. Pressing FI gives you a display of server names among which to choose. You can make connections manually by typing the server and log-in names or the address.

Once you're connected to a remote PC, everything displayed on the remote screen appears on yours, and everything you type is sent to the remote PC. You've really got to see NETmanager at work to believe it;

it's nothing short of amazing, and it's lightning fast.

While you're connected to the remote PC, NETmanager allows you to examine records in the user database. The display shows data for the PC you are controlling.

When you break the connection, you have the option of logging the trouble that led you to disconnect (by creating a record, or "trouble ticket," in the log database. The log database record includes time connected, person called, and problem type. You can use the log database to track net-

NETmanager has a user database available at all times with reminders about each user, the equipment installed, and applications commonly run.

work activities for billing purposes or to see what equipment or software is causing

When you're finished logging the call, you can have NETmanager create a number of different reports, or you can "roll your own" using dBASE III. NETmanager sorts by user, problem, department, server, or node. It will also give you the details of "trouble tickets."

trouble for users.

NETmanager, Version 1.20, offers no multiuser access to the user and log databases. On a network with multiple help desks, each help desk must maintain its own set of databases. Brightwork plans to remedy this limitation promptly and to offer a field upgrade that allows multiple help desks to access one set of databases.

TWO TYPES OF PROTECTION NETmanager protects the network and its users in two ways. First, two passwords make remote PCs secure. You set one password by using an option in the NRLISTEN command line. The network administrator sets the other by using a NET-manager utility. Both passwords are encrypted before being stored. The network administrator's password can override the user's password

NRLISTEN's command-line parameters afford the second type of protection. These parameters can enable or disable the keyboard of either the administrator or the local user. NRLISTEN can also permit or prevent a hard reboot of the called PC and can refuse new calls.

can retuse new caits.

Users can add passwords to the diskresident version of NRLISTEN only by running a program called ADDPASS.
When NRLISTEN is in memory, ADD-PASS cannot act on it. To protect your passwords, you'll want to keep both ADD-PASS and NRLISTEN (with password inserted) in a read-only directory.

FEW PROBLEMS NET manager is a highly sophisticated program, and it does have a few foibles. Although it works equally well with any mixture of display adapters, you must use it with well-behaved application programs that use DOS calls and don't direct calls to BIOS or hardware registers. The latter restriction means that you won't be able to use NETmanager with many graphics programs. Also, using Lotus 1-2-3, Release 1.0a, with NETmanager causes problems with the graphics display (but using 1-2-3, Release 2.0, causes no problems). And NETmanager won't operate with SideKick and a number of other TSR programs that use the keyboard interrupt. Using NETmanager with incompatible programs causes one or both PCs to lock up, requiring you to reboot.

Nothwithstanding these minor problems and its pretty steep \$1,495 list price, NETmanager is a great program. It can help you solve problems anywhere on a LAN fast—without leaving your desk. —Tom Wisniewski

The Network Courier Inter-Network Version

Inter-Network Version
Like cc.mdu LAN Package, The Network
Courier Inter-Network Version, 5995
from Consumers Software, is a full-featured e-mail package for creating and receiving mail on a LAN. The program is
memory resident and (if you have sufficient RAM) lets you quickly check your
mail and send notes to other people on the

network. (See "Making Connections:

The best ad for Key Tronic keyboards is a close look at the competition.



Last spring a certain quality conscious consumer purchased what he thought was a Key Tronic KB 5151 Profes-

sional Series keyboard from a local retailer.

This same Look for the Key Tronic Professional consumer later Series label on the keyboards top returned the

keyboard to Key Tronic with a letter of complaint. The product, shown above, was used for just over a year, though it looks like it was abused for much longer. Some of the keycap legends had worn away, and had to be replaced by the stickon labels you see here.

Truth is, while the above product was sold as a Key Tronic never appeared on the product. There is no way it could have. Because only keyboards bearing

the leading name in keyboard technology offer the quality behind that name.

Close examination will tell you immediately if the keyboard you are purchasing is from Key Tronic. First, look for the Key Tronic Professional Series label in the ton left hand corner. Look also at the keyboard's legs to see if

they have a rubberized non-skid Professional Series



Of course there are other features, not initially apparent, that separate a great keyboard from a mediocre one. Take Key Tronic's double shot molding, for example, a process that prevents the keycap legends from wear-

ing away (which proves that the kevboard shown above is not from Key Tronic but

rather the handi-And then there is Key Tronic's

work of a lesser manufacturer). limited three-year warranty: a

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Inter-Network Version Consumers Software 314 E. Holly St., #106 Bellingham, WA 98225 (604) 688-4548 List Price: \$995; The Network Courier Six-

User Starter Kit, \$295; The Network Couries Single Server, \$695. Requires: 128K RAM, 60K RAM for memory-resident monitor program (optional);

DOS 3.1 or later.
In Short: This RAM-resident e-mail program supplies a full range of mail services for LANs. At times, its operation is less than logical. Not copy protected.

GROUE TRACH PLACE SERVICE CARD.

Two E-mail Systems for LANs," in PC Magazine, December 8, 1987, page 303, for an in-depth look at this package.)

Network Courier features a ring menu with selections for reading, forwarding, deleting, and storing messages, and for taking other actions. A full-featured text delitor makes message creation easy, and an address list helps you find the addressess. Our reviewers didn't like the keystroke sequence that is used for tragging addressees, but it does become men natural after only a couple of sessions using it.

Network Courier will notify you when mail arrives while you work in your application. You have several options, ranging from silent storage of incoming messages to flashing and beeping messages on the screen. You can store messages in either private directories or public directories that are accessible to anyone on the system, but Network Courier does not have a public bulletin board system like the one in cc/Mail LAN Package.

When you receive a message with attachments, Network Courier lets you handle the text file and the attached file separately. You can then save each under a unique name or delete them both.

unique anti-or userse themroon.

**Pertured Courter allows you to sort messages according to the date they were more according to the date they were the sort of the program allows you to much sections of a message for special transtment. For instance, you can save a section of an incoming message into a postle file or import part of a stored message into a message that you are composing. You use the FS key to import the contents of an ASCII text file stored anywhere on the network.

The Network Courier external mail program allows you to exchange mail with other networks. To use this program, you boot it in a dedicated network station capa-

ble of asynchronous communications and keep it running as long as you want mail acchange to take place. The network administrator assigns names, telephone numbers, and the passwords of the remote post offices into the system. The network administrator must also indicate the other networks' hours of operation, which the system then uses to determine when to call and transfer mals.

The program comes with utilities that help in installing and maintaining the system. Status displays keep track of statistics on network activity, and utility services let the administrator limit users' privileges, assigning receive-only or send-only capabilities for special applications.

Although in some cases we didn't agree with its menu and keystroke design, Network Courier is a competent program that provides complete service to busy e-mail users.—Frank J. Derfler, Jr.

Right Hand Man

If you've developed a taste for TSR (terminate-and-stay-resident) desktop accessories, one that'll really whet your appetite is Right Hand Man, from FutureSoft. Billed as "the ultimate desktop organizer," the program comes in both single-user and multiuser LAN versions and sports a host of useful features. It's powerful, fast, flex-

AS RECENTLY AS YESTERDAY, A TRULY SOPHISTICATED ANSWERING SYSTEM SOLD FOR \$20,000. ible, and low-priced: 5-user version, \$149; 10 users, \$289; 25 users, \$399; and so on.

A memory-resident executive that invokes disk-resident modules is the heart of Right Hand Man. The 15 modules that make up the package provide networked electronic mail, an appointment calendar. ASCII table, telephone directory with dialer, two calculators, a DOS command window, editor, private and public notepads, Rolodex, macro recording, typewriter, and import/export window.

The multiuser versions let 5, 10, 25, 50, or 100 network users have their own individual copies of Right Hand Man, offering everyone the flexibility to maintain personal files (like notepads and indexes) vet use common resources through the network, like customer lists, telephone number lists, electronic mail, and shared calen-

Right Hand Man consumes approximately 120K of RAM in its default configuration. You can pare that down to about 46K without losing any features, but you'll notice some loss of performance. The latest version of Right Hand Man conforms to the LIM EMS 4.1 specification, so if you have memory above 640K, this program can use it. You can remove Right Hand Man from memory at any time, provided it was the last TSR program loaded.

Since many network programs take

affordable voice mail system you can buy





Right Hand Man, Version 4.1 FutureSoft Inc 0665 Tanelewood Lane P.O. Box 1489 Silvenborne, CO 80498 (800) 327-8296 List Price: Single user.

59: 5 users, \$149: 10 users, \$289: 25 users. \$399; 50 users, \$695; 100 users, \$1,000; upgrade from previous version, \$19. Requires: 48K RAM, one disk drive, any

MS-DOS LAN. In Short: This well-integrated RAM-resident unlity offers e-mail and import/export capabilities. Multiuser versions use record locking in Black Book, Guarded Notepad, Notepad, and Index File modules. Not copy LE 672 ON PIEAD

120K of RAM themselves, you will probably want to reduce the RAM used by this utility as much as possible when running it in networked computers. Otherwise, a PC with full network services and full Right Hand Man services won't have much RAM left for normal applications.

Right Hand Man can have up to 60 modules (including multiple copies of the same module) active on the screen simultaneously-if you don't mind some very small boxes! You can customize all of the modules, adjusting the color, size, and position of each module's display to suit your

You can set other parameters, too. From the main menu, for instance, you configure the communications port, select a print device, or set the length of the typeahead buffer (up to 96 characters). Even the pitch and duration of the beeps generated by the program are variable.

Right Hand Man's user interface is well thought out, integrated and consistent. No matter which module you're using, the same keystrokes do the same thing. Pressing Alt-H any time that a module is running displays a help file on the screen. Pressing Esc backs you out of help, Right Hand Man, or any of its modules.

The slickest part of Right Hand Man, though, is its import/export capability. Text can be gleaned from files-or other modules-and sent just about anywhere, including your printer or modern.

THE MODULES E-mail is a new feature in Right Hand Man, and it works well on any network (NetBIOS is not required). The e-mail package allows creation of mailing lists, instant reply to single or multiple addressees, and the attachment of data files. The system lacks the ability to



go to multiple post offices, so it is only useful on a single LAN. It also fails to offer notification of mail arrival, but otherwise it is a valuable addition to programs like IBM's PC LAN that lack e-mail functions.

Right Hand Man includes two 16-digit calculators. Both can handle ordinary arithmetic operations like multiply and divide, Boolean functions (AND, OR, and XOR), reciprocals, percents, and base conversions. The only difference between them is that one simulates a paper tape on the screen. (If you press F10 to route either calculator's output to a printer, you've got a very expensive adding machine!)

Publishing an organizational telephone directory is always a problem. Right Hand Man lets you create an on-line directory, or "Black Book," of telephone numbers that can be shared by anyone on the network. The index will hold 12,000 entries, each up to 256 characters in length. Right Hand Man dials the telephone using your modem (it is preconfigured for Hayes modems). You can sort your indexes, or search through them using wildcards. On a network, the records are locked only when they are being created or changed.

The Black Book index has the same features as the Index File. The only difference is that in order to examine it, you must specify a password up to 30 characters long. For added privacy, Right Hand

Man encrypts Black Book index data files. You can use the Resident Editor to edit ASCII files up to 130 pages long (64K) or up to the limit of available memory, whichever is less. The editor even has a graphics mode that allows the display of the full IBM PC graphics character set.

Right Hand Man's slick import/export capability lets you glean text from files and send it almost anywhere.

Switch to graphics mode while in the Resident Editor, and every text character you type appears as the corresponding graphics character. Word wrap and global search and replace are in both the editor and notepad. On a network, the ASCII files are locked when one party is using them, but available to all at other times.

The Resident Editor functions, including file locking, carry over to Right Hand Man's Notepad and Guarded Notepad; you can use either one for jotting down quick notes. When you exit the module, Right Hand Man saves your notes to a notebook file on-disk. The Guarded Notepad, like the Black Book index, protects your data with a password and file encryp-

Right Hand Man includes an Appointment Calendar and Alarm to help you keep track of appointments: the alarm interrupts you at the scheduled dates and times. You can also preset recurring events like birthdays or anniversaries. The calendar can hold up to 2,000 characters per day in its appointment schedule window.

In the LAN versions of Right Hand Man, your calendar is available to all the other users on the network so that they can see when you are available. As with many "public" or networked calendars, however, you may wish to enter only your "available" and "busy" times to keep some privacy.

If you're running a foreground application, Right Hand Man puts DOS at your fingertips. Although DOS à la Right Hand Man is a lot like regular DOS, it's finicky. Run the wrong program inside Right Hand Man's DOS window, and you can wind up having to do a cold reboot. What's more. anything you do in the DOS window changes the environment of your foreground program.

The Import/Export module is Right Hand Man at its best. The system uses an

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hether you want the best portable or desktop, the best 80286-or 80386-based personal computer, there is only one choice: Compag. Because COMPAQ personal computers are consistently atted the best in each class by both industry experts and sophisticated users.

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It simply works better.

export buffer in RAM as a transfer point for all data. Actually, you save data to the export buffer in one module and extract it in another.

The I/E module reads your screen display to import data, so the size of the current foreground screen limits the amount of data you can import at one time. If you want to import more data, send the existing imported screen to the export buffer, leave Right Hand Man, use the foreground program to get the next segment of text on the screen, and repeat the process.

You press Ctrl-E when you want to export the contents of the export buffer to the active screen. Right Hand Man takes control of your keyboard and literally types the text in for you. By exporting in such a manner, Right Hand Man remains independent of whatever foreground program you're using.

MACROS AND MORE Right Hand Man also offers a convenient keystroke recording/editing capability. A buffer, which holds the last 96 keystrokes, can be played back or edited, and keystroke combinations can be linked to special macro keystrokes. You can create up to 31 temporary or permanent macros.

The on-screen typewriter works just like a line-correcting typewriter. Anything you type before pressing Enter goes into a buffer. You use the backspace key to back up and correct any typing mistakes, then press Enter to send the buffer's contents to the printer.

Right Hand Man is handy because it's always available, and its Import/Export facility is top-notch. But one caveat-the program suffers from a shortcoming inherent in all TSR programs: It can, and occasionally does, unpredictably crash your computer. Your best bet is to check Right Hand Man's compatibility with each network program you run .- Frank J. Derfler, Jr., and Tom Wisniewski

Shoebox 3

Organization mayens are the ideal market for R+R Associates' Shoebox 3, a timeand expense-management system that sells for \$350 plus \$10 per workstation for the network version. The networked version gives you automated tools to coordinate





R+R Associates Inc. 39 Carwall Ave Mount Vernon, NY 10552 (914) 668-4057 List Price: Shorbox 1. \$59; Shorbox I Plus

\$95: Shorbox 2, \$195: Shorbox 3, \$350 plus \$10 per workstation Requires: 198K RAM, DOS 3.1 or later. In Short: This time- and expense- management program for networks handles calendaring, appointments, reminders, and expenses; it also finds available time slots for multiple users to meet. Not copy protected. CIRCLE (AT ON READER SERVICE

your schedule with other Shoehox users.

Shoebox 1 is the single-user version, and allows scheduling. Shoebox 1 Plus adds expense reporting and other features. Shoebox 2 is multiuser, but the version is only for one machine. Shoebox 3 is the full-blown, multiuser, network version.

Alas, a pocket calendar easily replaces the single-user Shoeboxes. And, entering everyone's schedule on one machine limits the convenience of Shoebox 2. Shoebox 3. on the other hand, can earn its keep if you are scheduling appointments for a number of people. The more schedules you juggle. the happier you'll be with Shoebox 3.

Shoebox 3 lets you choose a hotkey from its predefined list of four. It consumes 198K of RAM whether it is running in the foreground or the background.

MEETING MAKER With Shoebox 3. you can schedule a meeting with any or all other Shoebox 3 users. The program checks everyone's schedule and avoids conflicts. The few seconds Shoebox 3 takes to find available time slots for six people beats the time it takes to make six phone calls or to check with everyone in person.

To schedule meetings, you first group the names of people you meet with regularly. These groups stay in the program and become available to all Shoebox users. When you choose a group from the menu list, Shoebox 3 displays the names of ev-

ervone in that group. As each name is highlighted, you press either Y(es) or N(o) to include or exclude someone from the meeting.

When you've gone through all the names. Shoebox 3 finds the times the se-

lected people are free and shows them to you. Pick a time, and the program schedules the meeting. Shoebox 3 can also schedule room and equipment use. TO DO'S The appointment screen

shows appointments for any day. You pick a day by using the Left and Right Arrow keys to move a highlighted cursor over Shoebox 3's on-screen calendar. You can also jump to a given day by pressing another D(av) and entering the date.

When you get to the approximate time for which you want to enter a new appointment, you fill in a template. You describe the appointment in 575 or fewer characters and set the start and end times of the appointment. You also tell Shoebox whether the appointment is recurring. The program will even alert you to the appointment several days in advance if you like.

Shoebox 3 can also give you a brief display of your appointments, which shows only the appointment dates and descriptions. The brief display covers appointments from the day you've selected to 31

days later.

You can print your schedule with the built-in print facility or the Shift-PrtSc function. A network manager could use Shoebox to print out the schedule of all subordinates, either in a consolidated report or in individual reports.

Similar to appointments, Shoebox's reminders are things to do, but they aren't scheduled for any specific time. Although they appear intertwined with appointments in the display, Shoebox 3 actually maintains reminders and appointments as separate databases.

You can enter reminders in any order and assign priorities to them at any time. If you choose to assign priorities, reminders appear in sorted order on-screen.

In the networked version of Shoebox, you can send reminders to other people (assuming the security and group identities allow it). This feature is not exactly electronic mail, but more like "electronic helpful hints."

Case History #60102

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EXPENSES When you press E for expenses, Shoebox 3 displays an expense screen. You then specify the account you are charging and include a category into which to put the expense, the amount you spent, and a short description of the ex-

Shoebox 3 can earn its keep if you must frequently schedule appointments for a number of people. The more schedules you juggle, the happier you'll be with Shoebax 3.

pense. The expense screen can also track other charges, like hours worked.

If you record all your appointments, remiders, and expenses, Shoebox 3 rewards you with a complete record of weat you've done and spent. You can always change anything you like, and you can archive data to conserve disk space.

Shoebox can sort a consolidated expense report for a number of people according to date, account, or category. You must export files from each user's account and then import them into a consolidated account, but it's almost easier to do that than explain it.

Shoebox 3 can help organizations save time and money. The scheduling system is particularly valuable. But you must be near your computer at some time during the day to use the software. And, the more your schedule changes, the more often you have to check in with Shoebox 3.

—Tom Winstewski

Workstation Wizard

Leader Systems' Workstation Wizard is a DOS-batch-file-based menu-management program that sells for \$249.99. It offers a pop-up electronic calculator, an auto-dialer, a security system, and audit trails and reporting functions, as well as a dazzling, user-friendly interface.

The Wizard has versions that run on standalone PCs as well as on networked PCs running Novell's NetWare, IBM's PC LAN, and similar DOS-based network operating systems. Many people will find its audit trail capability useful in network apnifications.

The program's standard DOS batch commands call up programs and files appearing on the menus. A DOS shell allows you to execute 20 of the more common DOS commands with a single-key sequence and user-friendly prompts. The networked versions have a similar shell for

the more common network commands. Installing and configuring the Wizard is easy; you simply follow the step-by-step menu prompts. Adding, modifying, and deleting menu and submenu options are menu-driven operations as well.

Since a menu management program is the first thing a user sees, it must be institive and attractive. Wixard meets this criterion by providing an easy-to-learn, easy-to-use, flexible, and full-featured system. The help screens are context sensitive, and you get to them by pressing a designated function key anywhere in the program. The screen displays are well laid out and more it around to any of three locations on the screen.

USER TOOLS Pressing the F2 key loads the SideKick look-alike calculator. Besides being able to perform simple arithmetic computations in decimal and hexadecimal, it has some memory capabilities. The calculator does not, however, pop up while you run other application programs; it is not RAM resident.

and the case treated in the case of the ca

The Wizard security system comes in the form of log-in passwords and security levels. On top of this system is the owner or head operator of the system, with a security level of nine. Having a security level





or later. In Short: This DOS-batch-file-based menu management program is handy when upgrand in guests from a standidout on a networked environment. It offers a pop-up electronic calculator, a muto-faller, a accurity system, and audit trails and reporting functions, as well as a diazing, user-friendly interface. Not copy protected.

of nine gives the user access to all of Wizard's features, including the capability to set up the security levels of other users.

Other security levels range from zero to eight. Users with levels zero to six can access help, the calculator, and the dialer. Level-seven and eight users can access the level-six features plus the DOS shell and the Network shell. Level-nine users have access to all level-seven and eight features plus access to all level-seven and eight features plus access to the security system, the audit trail, and reporting functions. Unfortunately, features allocated to certain security levels are no user-definable.

AUDITING ACTIONS
As audit and management took, the audit trails and reporting functions are indispensable. Wirard's audit trails keep track of who was on
the system, how long they were on, and
which programs they executed during that
which programs they executed during that
Day to the program Utilization, and the
Dayl Log reports. The User ID report lists
users on the system. The Program Utilization
in report shows how much time was
sperit on each individual program. The
Dayl Log lists the users on the system as a
Dayl Log lists the users on the system as

You can use the Wizard in many different applications. Some that come to mind include system integrators using Wizard as a tool to furnish a customized and userfriendly interface. On networked PCs the

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APPLICATION SOFTWARE



cc:Mail LAN Package
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In the case over of integrated desktop pathiese, he Editor's Choice goes to Right Hand Man. This bundle of stillines coas shoul \$50 per sure in packs for five workstantons. Some of the programs, such as the two calculators, have no special networked features, but others, such as the selephone directory and advoces the same data fife a the same time. Arm congulations with a LAW will find Right Hand Man useful fee exhibiting private and shared on-line and-daling sele-

phone directories and mailing lists. If it's electroiic mail capabilities von ir e dier, we recommend cc: Mail LAN Package. This electronic mail program offers loads of features. Of particular interest, it allows you to set up bulletin boards. You can also capture and display graphics screens along with text. And the program's user interface is so well designed that you may never have to refer to the manual.

refer to the manual.

Shoebox 3 is the clear choice for group calendaring applications. If people keep their schedules up to date, Shoebox makes it a snap to date, Shoebox makes it a snap to their, them together for a meeting. The program is cost varies with the number of users, but ten people can use Shoebox on the network for about 345 each. Its other functions include expense recording.

Wizard makes all the logical drive mappings, the sequence of program execution, and other network operations transparent to the user.

The Workstation Wizard is useful in upgrading users from a standalone to a networked environment. It eases this transition by giving the same look and feel to both environments.—Roberto Rivera

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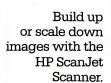
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COVER STORY

ADMINISTRATIVE RELIEF FOR



Most network operating systems leave a gap when it comes to tools for network administration. Eight LAN utility programs try to fill that gap, offering network managers a mix of options to meet their need for administrative assistance.

A though years of experience with minicomputer operating systems have demonstrated the value of activity-monitoring, auditing, and bill-back systems for LANs. even highend operating systems—with a few notable exceptions—don't offer these capabilities. The market's response to the need for tools for network administration is a mixed ground LAN tailities that offer a pinch of this and a dolloy of that.

The eight utility programs we evaluated

generally try to fill in the gaps in network operating software. Offering features that rightfully should be available there in the first place. Those LAN utilities include Westron Associates' ARC-Monitor Plus and E-Monitor, 3Com's EtherProbe. Computer Communication's LAN MAP. LAN Services' LANVIAIL, FTP Software's LANVIAIL, FTP Software's LANVIAIL, FTP Software's Assistant.

Some are intended for use on any network, while others are for exclusive use

with one operating system. ARC-Monitor Plus is for use on an ARC net LAN, while LT Auditor, LANTrail, LAN MAP, and Network Assistant are designed for use with Novell's NetWare. EtherProbe and E-Monitor are intended to supplement an Ethernet LAN—also the primary application for LANWatch.

As the reviews that follow attest, these add-on third-party LAN utilities range from so-so to excellent. You'll also notice that they occasionally share features with some of the workgroup productivity programs that we also review in this issue. The line between the two groups of programs is sometimes a blurry one.

Not everyone with the duties of a network administrator needs a stack of network utilities. But as installations and applications grow larger and more complex, so does the value of automated tools for network monitoring, activity tracking and logging, and troubleshooting. —Frank J. Derfler, Jr.

ARC-Monitor Plus

ARC-Monitor Plus, a low-cost (575 per LAN), easy-to-use diagnostic tool from Westoon Associates, offers the features that you need in order to to check the status of your network periodically. Designed for networks using the ARCnet cabling and access protocol scheme, it enables experineed network managers and installers to determine where problems lie or how much the network is used.

In most cases ARC-Monitor Plus gives



you plenty of information to go on. What the program doesn't do is decode information inside the packers, the way such Elbinath LAValyzer do. Nor does it tell you in packets are generated by NetBloS or the Server Message Block parts of the networking software. And although it does in add Corp.

tell you how many packets are moving on the network and how well, it does not report what they are doing.

STARTUP OPTIONS You can start ARC-Monitor Plus with several options, including token counting, setting the screen up to display node activity, and creating an ASCII "nodemap" file. You can use this file, with its node addresses, packet counts, and node names, in word processors, databases, and spreasheets.

ARC-Monitor Plus can tell you how many packets each node generates to give you a picture of activity. A typical installation uses coaxial cables to hook each node together through a series of hubs.

With nodes using a token-passing scheme to regulate the order of transmission on the cable, ARC-Monitor Plus monitors the activity of tokens and packets card. It works with most common ARCnet card, including those from Standard Microsystems, Pure Data, and Thomas Conrad Corp.

(Products listed in alphabetical order	ARC- Monitor Plus	E-Monitor	EtherProbe	LAN MAP	LANGrail	LANWalch	LT Audiller	Network Assistant
lumber of authorized users	1	Limited only by server	1	10	Limited only by server	1	Limited only by server	Limited only by server
letBIOS required		0						ia.
femory-resident	10	191			•		(shelt only)	•
demory required in background mode	NA	NA	N/A	NA	5K per workstation	NA	20K on each audited station	29K
demory required in foreground mode	128K	128K	256K	128K	256K	150K	145K (on supervisory station only)	N/A
Record and file locking included	0	0	DI	0.	0	0	0	0
Aenus included	•	0	•	•	•	0	•	•
racks network usage		O.			•		•	
On-line help available	•	•		•	ō			0

A LOOK IN THE BOSS'S TOOLBOX

Options for the network administrator include tools for generating reports and maintaining an on-screen history of members' activity.



This E-Monitor screen depicts the amount of data flowing through the network at 1-second intervals; the chart's range is autonatically scaled to meet the ochual conditions. In this example, one burst of activity reached 80 kilobits of data per second.



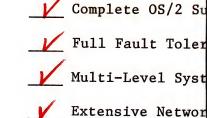
Once LANtrail's raw data is compressed, the program's batch mode allows overnight generation of several different reports. After LANtrail executes the commands in the batch file, it can automatically log the supervisor off the network.



One screen in LAN MAP displays a list of users signed on to the network. While this allows the network manager to keep an eye on who is using the network, there's no indication of how much activity is toking place.



In the LAN Access History Log, LT Auditor shows the log-in and log-out times for every audited user. Also helpful is the File Access Report, which shows who used what, when and where, for every file access matching a user's filter.





Traditionally, the MIS world has viewed PC-based local area networks with a healthy dose of skepticism. A "prove it to me" attitude. And in an arena ruled by powerful mainframes, that approach has given rise to a few misconceptions and doubts about LAN performance.

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SFT NetWare v2.1 simplifies network management with menu-driven utilities that let you control the network from any workstation. Advanced accounting features allow you to audit and account for users or departments utilizing network resources. Available communications links give you unsurpassed connectivity with mini/mainframe systems and other LANs. And SFT NetWare v2.1 supports OS/2 as well as DOS workstations.

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■ LANUTILITIES

The program captures up to 1,000 packets per second. But since even this rate isn't fast enough for some busy networks, Westcon cautions against relying on the raw packet count as an accurate performance measurement-some packets can be lost.

OTHER FEATURES The ARCnet architecture uses a process of network "reconfiguration" to add or delete stations on the network as they go active or inactive. Recons, as they are called, are a normal part of ARCnet operation. But repeated recons also occur when a network interface

card or hub is failing or the cable is bad. Since reconfigurations are invisible to the networking software, you might note a degradation in performance but see no erfor messages or other sign of trouble. In that case, checking the reconfiguration tables displayed by ARC-Monitor Plus may show repeated reconfigurations and indicate the suspect card or hub. ARC-Monitor Plus also comes with a memory-resident program that will flash a banner and beep when a reconfiguration occurs.

In addition, ARC-Monitor Plus can collect data for up to 32 nodes at a time. You can select a segment of numbered nodes to monitor, and the program will total packet counts for the group of nodes that you have selected.

The Token Timing graph is useful in determining whether your LAN has reached its capacity. The timing graph gives you four types of information: Token Passing, Message Overhead, Data Transfer, and Reconfiguration.

Token Passing counts the number of times a token or free packet is given to a particular machine during a period of time. The number is multiplied by the number of nodes on the network to determine the time spent passing the token. Message Overhead refers to the amount of extra time spent sending message "overhead" characters and checksum values. Data Transfer measures the time it takes to send a single byte to another machine. The Reconfiguration measurement shows the percentage of time spent in reconfiguration. Another handy feature is the cable test, which tells you whether you have lost the physical connection to the network.

Although it doesn't meet the needs of

every network software developer, it does give installers and administrators a clear window into the ARCnet LAN, Added to its low price and easy-to-interpret displays, that capability makes ARC-Monitor Plus a handy tool for use with an ARCnet I AN -Fdward Halbert

E-Monitor

E-Monitor, from Westcon Associates, a New York-based network systems company, is a basic network monitor that sells for \$75 per Ethernet LAN. It can show you the amount of data that an Ethernet network transmits, the percentage of time the LAN is active, and the presence of bad or broken network packets.

E-Monitor is not designed to be a fully featured analyzer. Instead, it's a low-cost, functional utility that's easy to use. The menu-driven program uses color effectively to display information. It presents the data in a graphic form that a novice or nontechnical user can quickly interpret. If you're a network administrator, you would probably run this package when your networked computer isn't doing other jobs-just to have a window into network operations.

RUNS ON WORKSTATION E-Monitor runs on a workstation, and Westcon recommends that you not run the program in conjunction with the networking soft-





me disk drive. DOS 3.0 or later In Short: This low-cost, easy-to-use pro gram for monitoring an Ethernet LAN is an

alternative to higher-end network analyzers such as Excelan's Ethernet Analyzer and EtherProbe from 3Com. The program run on most common Ethernet cards and requir no networking software. Not copy protected. CITCLE 646 PAPILA

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LAN UTILITIES

ware. You simply load E-Monitor and answer a couple of questions about your hardware. The program is compatible with networking cards from 3Com and other vendors

After the program starts, you can select one of four tests: Bandwidth Usage, Network Data Capacity, View Information (packets) Center, and Cable Test. The Bandwidth Usage test shows what percentage of the bandwidth is being used.

The program samples the network and displays data at 1-second intervals. The network administrator can determine if the network is heavily loaded by looking at the scrolling bar chart on the screen.

In the Network Data Capacity test, E-Monitor counts data in a real-time mode and keeps minute-by-minute averages. You can see the number of good-to-bad packets sent through the network.

The View Information option tells E-Monitor to capture the data being transmitted over the wire. The program can capture nacket headers containing source and destination ID, packet type, and packet length, and analyze these features to determine network stability. The cable checker feature sends a packet down the cable and can report a bad or unterminated cable.

If you manage an Ethernet network, you should have E-Monitor in your toolkit. It's easy to use, even for a nontechnical person, and it's an inexpensive and useful window on the LAN .- Edward Halbert and Frank J. Derfler, Jr.

EtherProbe

EtherProbe is a software-only, low-cost (\$995) entry into the LAN analyzer market from 3Com Corp. Working with 3Com's standard and microprocessor-equipped network interface cards, EtherProbe's primary strength is analysis of the network protocols used in 3Com's 3+Share.

Installation is easy. The instruction manual offers detailed instructions; all you do is make a boot disk and transfer the contents of the program disk to it. But to address the network interface board, you must have the software drivers that come with 3Com's 3+Share software.

EtherProbe makes it easy to set filters so that you can see packets going only to or

from certain stations. But doing so is usu-

ally necessary, since the EtherProbe buffer can hold only 200 packets before it starts overwriting the oldest information.

The small buffer size is the program's biggest limitation. With carefully timed sessions and the use of filters, though, you can reduce the impact of the small buffer size. You can also use an automatic trigger and limit collection to the maximum of 200 packets.

To help identify your data packets, you can specify names containing up to 12 characters to replace the 12-digit Ethernet station address number. A nifty overlapping window display allows you to enter station names and the category (server, user, and so forth) of the station. These identifications are useful for sorting and analysis.

DIFFERENT FORMAT EtherProbe departs slightly from other analyzers in the format in which it presents system activity. From the main menu, you see a summary of conversations between different nodes. along with packet counts and directions. The screen highlights the most active conversation. Packet transmission shows up on the screen as a small face symbol along with an arrow pointing in the direction the packet is traveling. You can zoom in on a particular "conversation" and see the packets either in the order of the conversation or in the order they appeared on the network.



performance. Not copy protect

EtherProbe will also decode packet header information for several types of packets. This information is in English, decimal, or hex fields with English

When using the EtherProbe software with an EtherLink Plus card, you can display packet arrival time either as an absolute time (in milliseconds) from a nacket

optimum performance and recognize problems before the users complain. EtherProbe gives you your money's wortheven if you use it only to learn how LANs operate.-Frank J. Derfler, Jr. and Greg Campbell LAN MAP

■ The \$995 EtherProbe

package will do as good a iob as a \$17,000 device in finding a malfunctioning card or determining who's loading a 3Com network.

that you "mark," or as relative time between packets. You can also display the percentage of network use at the time the packet arrived.

INTERPRETERS EtherProbe includes protocol interpreters for the packets commonly used on 3Com systems, including the XNS (Xerox Network Standard) protocol stack, the IEEE-standard Ethernet packets, and the 3Com extensions to Microsoft redirector SMB (Server Message Block) packets. Unfortunately, you cannot add protocol interpreters to the existing

The documentation includes diagrams of typical screens, and several appendixes with technical information. 3COM supplements the operating manual with the Theory of Operations manual, which describes the Ethernet architecture to belp you understand what you see on the screen. As with most products, the best way to learn how to use the program is to experiment. EtherProbe is a great way to learn about and troubleshoot all the things that go on inside vour network.

The \$995 EtherProbe package will do as good a job as a \$17,000 device in finding a malfunctioning card or determining who's loading a 3Com network. Although LAN MAP, which Computer Communication markets for \$195, is a simple networkmonitoring and activity-logging utility program for Novell networks. Administrators of Novell networks use it to see graphically which workstations and users are logged on to the network.

it won't help you find cable breaks, it will

(with patience and some manual data re-

cording) help you configure your LAN for

The LAN MAP package includes a simple editor and a program called NetList. Net List lists the active file servers, showing each logged-in user name and the associated physical node address. You can use the output of this utility as an input into a MAP file (although you must know how to use DOS redirection to do so) and then edit the MAP file. LAN MAP uses this MAP file to create a display showing active users and their associated workstations.

You can create a screen display with the editor, which lets you position each node name in different places on the screen. The number of node names you can get on one map screen depends on how you arrange the map and what other information you





LANMAP Computer 151 New Park Ave. Hartford, CT 06106

(203) 236-5873 List Price: \$195 Requires: 256K RAM: ne disk drive; Novell's Advanced NetWare. ersion 2.0A or later; DOS 2.0 or later.

In Short: This relatively simple program which displays active stations and users on a Novell network, offers simple activity logging and is fairly easy to install and use. Not copy protected. CIFICLE 663 UNITEADER

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■ LAN UTILITIES

associate with each node.

When the program runs, active nodes are highlighted on the screen. On a color monitor, the nodes appear in brown characters, on a monetorme monitor, the nodes appear in brown characters, and amonchrome monitor, they display as normal-intensity characters. At a fine regular intervals, LAM MAP polls the network for active nodes and displays the log-in name of each user on the LAN in place of the physical node address.

Accompanying each log-in name is the

network station I/O of that node. LNN MAP displays log-in names for users who displays log-in names for users who logged in to LN MAP's default server in yellow on a codor monitor (high intensity on a monochrome monitor), in contrast, it displays users who are logged in to other servers on the same network in brown characters (normal intensity on a monochrome monitor).

PISTALIATION LAN MAP is easy to install, but the installation program that comes on the disk isn't a program. When you Pistallation of this application, gives a toll-free number to call f any problem cocur, and finally lists the four steps for installing the program yourself:

1. 2: < Feiter 10 make SYS:PUBLIC

- the default drive]
- 2. NCOPY A:*.*Z:*.* < Enter>
 3. FLAG Z:LANMAP.COM SRO
- <Enter> [to make a read-only file]
 4. FLAG Z:NETLIST.COM SRO
- <Enter> [to make a read-only file]
 If you need an instruction manual, LAN MAP includes a 25K ASCII file on the disk, which you can read on-line or print out as hard copy.

SIMPLE MENU You run LAV MAP by choosing from a simple ment that lets you display a map, cell a map, or select a specific map. The map display is useful because it tells the system administrator who is on the network and where, depending on how you organize the map. You can arrange display maps by server, workgroup, users of a specific application, or any other category. LAV MAP can monitor up to 255 users and eight attached servers.

When you display the map, you can choose from a couple of options. You can require a password before leaving the displaying mode, which enables the administrator to walk away from the terminal and keep the map up without worrying that someone may copy or destroy files.

Another option enables you to obtain a record of how many users are logged in to the different file servers on the network. You specify the name of the server's log file and how often you want it checked () to 30 minutes). An additional option lets you search for a specific user by log-in name. You could use this listing to bill for and/or predict system activity

LAN MAP isn't all things to all people. You need some DOS proficiency to run the program, but no more than a network administrator needs for other tasks. If you take the time to set it up. LAN MAP can show you what's happening on your LAN. -Richard Hubbard

I.A Ntrail

With Novell's NetWare flexing its muscles as one of the most popular network operating systems going, it isn't surprising to find utilities like LANtrail, from LAN Services, for \$595 per server. LANtrail watches and logs all user activity on your Novell network.

Designed as a supervisor-only tool, LANtrail comes in two parts. One part, LANTRAIL.COM, runs memory resident on the workstation and logs all file activity.





LAN Services Inc 19 Rector St., 15th floor New York, NY 10006 (2t2) 797-3800 List Price: \$595 per server.

Requires: Novell's Advanced NetWare/86 and NetWare/286, Version 2.0 and later. Supervisor: 256K RAM, IBM-compatible dedicated file server; wo ion: DOS 2.1 or later.

In Short: This network audit utility for Novell's NetWare systems features eigh of network activity reports. The RAM-resident workstation module logs all network activity, and report generation is sophisticated but slow. Not copy protected.

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■ LANUTILITIES

consuming only about 5K of RAM.

The other part, LANTRAIL.EXE, generates reports; you can also use it to set up default values for reports and printers and to define tokens. LANTRAIL.EXE can operate unattended in batch mode, in which it will sequentially execute sets of

report-generation commands.

PRODUCING BEFORTS LANnuity or me force lies in the number and variety of reports it offers. The program's Network Access Report displays user name, Effected address, log-in date/time and log-tol the supervisor know whether a user remained logged in overlight). The File Acmined has considered the supervisor know whether a user remained logged in overlight). The File Acmined has been address, and date/time that files were opened or closed. LANnuil summarize's any file operations that took place: open, read, write, check/modify date/time flags, or

The program logs all changes to network security parameters in the Bindery Changes Report. Whenever someone adds or removes a user, or changes password or truster eights, LAVIrall records it here. Whenever a user accesses an application program, LAVIrail makes an entry in the Programs Executed Report. While this report is easier to read than the File Access Report, it doesn't contain nearly as much information.

If you're interested in knowing when users manipulate files and directories, LANirail comes to the rescue with the Rename, Create, Delete Report. A Directory Usage Report presents a glorified directory tree showing the percentage of disk space each directory uses. It also shows the size of directories in bytes and how many files they contain.

The System Error Log alerts supervisors to network problems by listing all system error messages. All entires appear in the order in which they occurred. Finally, the Security Report gives supervisors a nicely formatted, printed copy of just about everything Novell's SYSCON utility reveals.

SORTING REPORTS LANtrail gives you several ways to sort reports. You can specify, for example, a range of dates with keywords like Today, Yesterday, Last_week, This_week, This_month and Last_month. Or you can sort reports by user, filename, date/time, and file server.

You can define a set of report defaults in LANrail and alter them whenever you like, they tell LANrail the types of reports that you use most often. Once the defaults are set, LANrail can generate customized reports automatically. For examples! For example, reports automatically. For examples! For example, and the LANrail means that look and feel exit like. NeWare utilities, to exclude a certain group of users. As you exclude a certain group of users. As you exclude a claud indicate which we take the Exclude Windows to the Exclude Windows the Windows the

LANtrail is preconfigured to support six types of printers, including the HP Laser-Jet Plus and the Epson FX-80 and FX-100, If you want to use another type of printer.

■ LANtrail's true forte lies in the number and variety of reports it offers. But generating reports is so slow that you may prefer to do it overnight.

you can define it by supplying the ASCII codes (in decimal) for a few printer functions, like compressed print and reset.

LANtrall has one major failing: slow report generation. Generating reports is so slow, in fact, that you may prefer to do it overnight. LANtrail compresses its raw data before it generates reports, and it takes almost a half hour to compress IMB of raw data.

The LANirail program compresses data by using tokens. Certain character strings such as severe manes, occur again and again in reports. When you define a sever name as a token, LaNirail replaces every instance of it in the raw data rike with a single character, the LANirail program could be considered to the contract of the contract

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■ LANUTILITIES

However, while the program records all LAN activity, it doesn't monitor the growth of the raw data files. You, as the supervisor, must keep checking the size of the data files and intervene when they become too large.

Overall, LANtrail works well and is easy to use. The eight types of reports are a plus but only if you can afford the time it takes to produce them. You be the judgebased on your individual network, the types of reports you need, and how long you're willing to wait.

—Tom Wisniewski

LANWatch

LANWatch, a Network analyzer from FTP Software, is a software-only, low-cost (\$1,200) entry into the LAN analyzer market. LAN analyzers capture and decode packets being transmitted in a network. and they vary widely in the type and number of packets they can capture and in how much analysis they can perform.

Designed for PCs with Ethernet or Token-Ring network adapters, LANWatch is particularly valuable in analyzing networks using the TCP/IP network protocols. LANWatch's true power, however, lies in what it does for software/protocol developers, for whom FTP Software supplies the source code listings for writing interpreters for new protocol implementations. This feature is particularly important



In Short: Primarily designed for an Ethernet ork, this product turns a PC with an Eth ernet or Token-Ring network adapter into a relatively low-cost LAN analyzer, particula ly strong for networks using TCP/IP a

to LAN software developers because it allows them both to debug and to measure the performance of their new products.

TWO MODES LANWatch offers two main operating modes. The first is the realtime capture mode; the second, the examine mode. In real-time mode the program continually captures packets from the cable and stores them in the queue. Once the queue fills up, LANWatch discards the oldest packet to make room for the newest. In examine mode it stops capturing packets to give you a closer look at what's already in memory.

You can display the information found in the Link, Network, and Transport lavers' protocols. Decoding these layers shows you who sent what to whom, how the packets were sent, and whether they were received.

LANWatch's main display lists the packets received. For each packet, the program displays time of arrival, length, source, destination, and type. It lets you toggle the display of each one of the levels individually. You can also toggle between showing the hex Ethernet address of the network adapter and showing the name of the manufacturer of the source and destination adapters. Help is always only a question mark away.

As part of its ability to recognize different protocols, LANWatch maintains statistics on the number of packets received using each protocol. Most important for troubleshooting is its ability to detect, classify, and count the many forms of corrupted packets.

Another useful feature is LANWatch's ability to maintain statistics on packet size (in 32-byte increments). LANWatch supplies both a list and a histogram (with a percentage of traffic scale) for packet sizes. This information helps in determining buffer sizes for network servers and the need for special network adapters using on-board buffers and processors.

FILTER CREATION Other important features include the ability to create filters and to save packets into a dump file for later viewing. LANWatch is capable of maintaining four simultaneous filters.

The first LANWatch filter is a background filter; it limits the packets accepted

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■ LANUTILITIES

from the network. The second, a viewing filter, limits the packets displayed on the screen. The third, the load filter, determines what packets the program loads from a previously saved dump file. The fourth, the save filter, limits the packets sent to a dump file.

You can filter on protocol type, addresses, and content; LANWatch supplies an extensive list of recognized protocol types. In the address filter, you can specify either hardware or protocol addresses. Content filtering lets you specify both byte and word matches as well as wildcards.

Perhaps most important, you can specify your viewing filter as a NOT and the direct all the output to a dump file. If that dump file is on a RAMdisk, you are free from the 254-packet limitation of the queue. The RAMdisk frees you from the relatively long access times of a hard disk, and the viewing NOT filter frees you from screen freesh.

EASY TO INSTALL AND USE Installing LANWatch is easy: it simply requires you to respond to e of few questions. You should establish a subdirectory for the files, and a new line in the CONFIG.SYS file will call the LANWatch driver for your interface card.

At startup, you can adjust the size of the buffer that LANWatch uses to store a packet. The default size is big enough to gather all the lower-level addressing and paritycheck information.

LANWatch is deceptively easy to use for such a powerful product. It is ease of installation and simple, intuitive commands give you a great deal of power quickly. While its extensive flexibility can be inmidiating a first to the uninitiated, it's a product that can grow with you, particularment of the product that can grow with you, particularment of the product o

LT Auditor

If you supervise a Novell network, you can get help from *LT Auditor*, produced by Blue Lance (\$495 per server). An audit rail utility, it monitors and meters who uses your network and how it is used.

Depending on how you configure it, LT Auditor can detect all types of file access

> PC MAGAZINE 264



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■ LAN UTILITIES

on the network file server or on a workstation's local drives. Its auditing is even better defined than the impressive statistics now available in SFT NetWare 2.1.

now available in SFT NetWare 2.1.
LT Auditor is really two programs.
One, called RAM205 COM, is RAM resistance of the real state of the re

The other program, the Supervisor Interface, resides on the file server and is available only to those with supervisor privileges. It gives the supervisor the power to define filters, crease reports, and redefine defaults established at installation. If you've worked with Novell's Supervisor Utilities (like SYSCON), you'll feel right at home with the Supervisor Interface; it looks and feels like Novell.

ERROR INTEGRATION LT Auditor is so highly integrated with Novell that it writes messages to Novell's message file NETSLOG.MSG. It reports errors, warnings, and messages to this file. Terrors are faults caused by LT Auditor. Warnings are allous detected by LT Auditor that it didn't cause. Messages contain information, such as when LT Auditor stared its auto-such as when LT Auditor stared its auto-



archive process. Network supervisors can thus detect problems that users ignore or are unaware of.

Installing LT Auditor includes defining a list of users to audit and specifying filters for each of them. A menu system guides you through adding or deleting names from the audited users list and creating, deletine, and editine a user's filters.

If you attempt to add a new user who has the same first eight characters in his name LT Auditor displays an error message and prompts you to reenter the user

From a security standpoint, LT Auditor helps the network supervisor keep an eye on sensitive files or subdirectories.

name. Once you define a filter for one user, you can copy the filter definition to another user with *LT Auditor*'s filter copy option.

LT Auditor can monitor all activity on the file server and a user's local drives, or just a part of it. Filenames can include wildcards,

You can also set up the file operations for auditing. LT Auditor monitors eight file operations: closing a file, deleting a subdirectory, crasing a file, making a subdirectory, opening a file, renaming a file, creating a file and writing a file. You can tell it to loe any combination of these events.

From a security standpoint, LT Auditor helps the network supervisor Keep an eye on sensitive files or subdirectories. Under normal circumstances, LT Auditor records who looks at and works with these files, but it's not foolproof. If the RAM203 COM program isn't resident on a workstation, all activity on that workstation goes unnoticed.

TWO REPORTS LT Auditor features two reports: a File Access Report and a LAN Access Report. The File Access Report, the more detailed of the two, shows I KNOW THAT REPORT IS IN HERE SOMEWHERE.

And GOfer is just the one to track it down. On a standard PC/AT, GOfer digs through files at a speed of over 1 Megabyte per minute. Most GOfer users find the information they need in less than 30 seconds.

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LAN UTILITIES

the user name of the person accessing the network and the address of the workstation being used, followed by the date, time, file operation, filename, and path for every file access that meets the filter criteria. The program can generate File Access Reports sorted by user, date, or audited filename, and it sorts and indexes reports as new records are added, speeding up report generation. You can generate reports on archived files as well as current files.

The LAN Access Report shows the workstation information, user name, time and date of log-in, and time and date of log-out. Unexpected conditions appear in this report, as well, Features similar to those of the File Access Reports are available in LAN Access Reports, although you can't sort by filename.

LT Auditor lets you include all users or just some of them. You can delete the ones you don't want from a list, and I.T Auditor retains the data for those users, in case you want it later.



. I.ANWatch LT Auditor

In the area of network auditing software, LT Auditor is the best buy. In addition to being simple to install, easy to use, and well documented. LT Auditor has filters that give it flexibility in tracing network actions. It can produce the two most important types of reports, the Network Access Report and the User Access Report, and it also includes several useful utilities for the supervisor. The report generation is fast.

If you need to look inside the packets or tokens moving through your LAN, LANWatch (\$1,200) has the potential to equal the TCP/IP packet-analysis capabilities of \$20,000 LAN analyzers. LAN gurus can program this product to provide impressive analysis capabilities on Token-Ring networks as well.



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■ LANUTILITIES

UTILITIES LT Auditor's utilities allow you to specify whether to run environment diagnostics automatically, purge system data files, or reset system parameters. Environment diagnostics check whether LT Auditor has the files, subdirectories, file attributes, and access rights it needs to function. The program is "self-healing"-it automatically detects incorrect settines and attempts to correct them. The Purge Active Files command deletes File Access History and LAN Access History files. LT Auditor prompts you to do this when either file reaches a maximum size specified by the supervisor, or when the automatic archiving fails owing to lack of disk space. It can also do the same thing automatically.

LT Auditor is a pro at detecting and reporting problems, and it enhances significantly the ability of the network supervisor to maintain the network.

-Tom Wisniewski

Network Assistant

Network Assistant, from Pacific Software, is a likable, \$195 memory-resident utility for Novell's NetWare networks that brings printing and messaging resources to the end user in a manageable form. Loaded at any time or from your AUTOEXEC.BAT file, the program springs to life when you hit Shift-PrtSc or any user-definable key combination If Network Assistant is the



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work Assistant Plus

es: 40K RAM; one disk drive; Novell's NerWare, Version 2.0 or later; DOS

In Short: This convenient utility offers no work printer sharing and messaging; it's easi ly implemented in any Novell NetWare

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last TSR (terminate-and-stay-resident) program loaded, you can free up its 40K from memory if necessary.

From the program's initial menu, you can choose a printer from a list of available network or local printers, manage the print queue, and select font styles supported by the selected printer. You also can send instant messages to other users on the network.

Choosing the spool flags option from this menu lets you select various attributes that affect the print job. For example, you can change the number of copies, change the forms type, or print so-called "banner

pages."

The banner page option lets you specify any ASCII text file as a banner page between printing jobs. This page identifies the person creating the job and often supplies administrative routing information. You can make several banner text files and use any one of them by dalcring the name of

the file in the banner page field; all print jobs are then prefaced by the specified text

PRINTER FROM EVERY PORT One handy feature of Network Assistant is the

nandy readure of Network Assistant is the ability to change the local DOS printer port (LPT1, LPT2, LPT3, and so forth) used as the network printer. If you have a particular word processor or spreadsheet that was set up to use LPT2, for example, you can tell Network Assistant via the menus to start spooding LPT1 to the selected network printer, so as to avoid having to reinstall the word norcessing software.

Installing the program is simple and straightforward. You must first call Pacific Software to get your 'key number,' which is required to install the program and use its printer functions.

You must copy the files on the distribution disk to a public directory on the server. The network administrator uses the NASETUP command to set up a configuration comprising the list of servers on the network, printers on each server, printer reset and font change strips, and the defaults for the spoof flags. The administrator chooses which printers to make available to users by adding them to his printer list. User defaults are set up for each workstation based on its physical node address, and you can assign different options to handle each user's individual require-

After the configuration process is complete, a file containing all the information is written to the disk. It's best to change to the directory where the configuration file resides before loading the utility. When the user loads Network Assistant, the program looks at the physical address number and uses the values set up for that user.

With Network Assistant, the mystery of network printer sharing is suddenly less foreboding.—Edward Halbert

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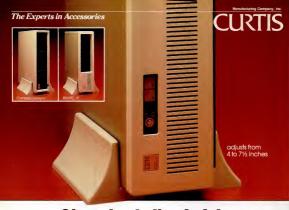
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Volume 7 Number 11 June 14, 1988

BASICA 3.x Identifiers

This Help File lists standard identifiers for Advanced BASIC 3.x. Some of these commands will not work in Cessette or Disk BASIC, in the BASIC Compiler, or in previous varsions of Advanced BASIC.

IBM-compabble computers require their own versions of BASIC, e.g., CW-BASIC. Most of the identifiers listed here will also correspond to these other BASIC versions, but some may not.

> SYNTAX: BASICA (Blename) (~input) (+) [+output](F:Bled [IS:baize] [IC:combutler] [M:[max workspace][,max blocksize]] [ID]

Rename - BASIC program file to load and run Input - file or device for redirected input

Input - file or device for redirected input output - file or device for redirected output files - number of files that can be open at once. Default 3: Maximum is number socialed in FILES- line of CONFIG.SYS minus 4.

number specified in FILES- line of CONFIG.SYS minus 4. belze = buffer size for random files. Default 128 bytes. Maximum 32,767 bytes combuffer - receive buffer size for communications. Default 128 bytes. Maximum 32,767 bytes.

max workingsee sets space allocated for BASIC data and stack segments Default 64K, max blacksize reserves space for assembly routines above highest location BASIC can address (65356).

BASIC can address (6558).

Of makes double precision mash functions resident.

BASIC derethers are variables, functions, statements, and commands.

Variables are variable for your exemination and use Functions return a value based on zero or more arguments. Statements and commands both perform an accore, but in general you use statements with regional programs and commands.

BASIC Commands

RESET—Close all disk files and clear buffers

SYTAX: RESET

RMDIR — Remove a directory

SYNTAX: RMDIR path

RUN — Run a program

SYNTAX: RUN [line]—or—RUN filename[,R] line = line to begin execution filename = file to load and run

R causes BASIC to leave open any open data files

SAVE — Save file on disk SYNTAX: SAVE filename[,A]—or—SAVE filename[,P] A = save in ASCII format

P = save In protected binary format SYSTEM — Leave BASIC and return to DOS

SYNTAX: SYSTEM

TROFF — Turn execution tracing OFF

TRON — Turn execution tracing ON SYNTAX: TRON

SYNTAX: TROFF

BASIC Variables

CSRLIN - The line the cursor is on.

DATE\$ — System date as a 10-character string in the form mm-dd-yyyy. NOTE: Set system date using DATE\$ function.

ERDEV — Error code for e critical device error (i.e., *Abort, Retry, Ignore?* error).

ERDEV\$ - Name of device for a critical device error.

ERL — Line number of program error. NOTE: In order for the line number in an IF statement involving ERL to be affected by RENUM, it must be on the right side of the operator, e.g., "IF ERL = 510".

ERR - Error code of program error.

INKEY\$ — Character read from the keyboard. NOTE: INKEY\$ contains a string of length 0, 1, or 2. Length 0 means no character was waiting. Length 1 is a standard keyboard character, Length 2 is a special extended keyboard character, Length 2 is a special extended keybode (e.g., function or arrow key).

TIME\$ — System time as an 8-character string of the form hh:mm:ss, NOTE; Set system time using TIME\$ function.

BASIC Functions

Arguments for BASIC functions: bytenum; A numeric constant, variable, or expression in the range 0..255.

dummy: Dummy numeric argument.

filenum: The number with which the file in question was

OPENed. number: A numeric constant, variable, or expression. offset: An offset from 0 to 65535 in the current segment.

Set the current segment with DEF SEG.

string: A string constant, variable, or expression.

ABS — Absolute value SYNTAX: ABS(number)

ASC — Convert first character of string to ASCII code SYNTAX: ASC(string)

ATN — Arctangent SYNTAX: ATN(number)

CDBL — Convert to double precision SYNTAX: CDBL(number)

CHR\$ — Convert ASCII code to character SYNTAX: CHR\$(bylenum)

CINT — Convert to integer by rounding up SYNTAX: CINT(number)

COS — Cosine

SYNTAX: COS(number)

CSNG — Convert to single precision SYNTAX: CSNG(number)

CVD — Convert string to double precision SYNTAX: CVD(8 · byte string)

CVI — Convert string to integer SYNTAX; CVI(2-byte string)

CVS — Convert string to single precision SYNTAX: CVS(4-byte string)

-Neil J. Rubenking





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■ PC LAB NOTES: BASIC GRAPHICS ■ ETHAN WINER AND BRIAN GIEDT

ADVANCED GRAPHICS IN BASIC

You can upgrade your graphics programming skills and learn the techniques for producing animation and tiling using these Turbo Basic and QuickBASIC routines.

ost programmers have at least some familiarity with the wide assortment of graphics commands that are available in BASIC. Indeed, one of the reasons BASIC has become so popular is the ease with which interesting and effective graphics may be produced. This article will focus on two areas of graphics programming that are often overlooked: animation and tiling.

Before taking up animation and some of the other advanced techniques, however, it's a good idea to take a quick look at a few of the important graphics primitives. Most of the examples presented later will be based on these fundamental building

Remember that before any graphics commands may be issued, you must tell BASIC which screen mode you intend to use. A CGA display can access only graphics screens 1 and 2, while a VGA can take advantage of many more. For the examples here, we'll assume screen mode 1, since any graphics display (except Hercules) can operate in that mode.

LINE The most basic graphics command is the LINE statement, which draws a straight line between two points. LINE is also used to draw boxes and rectangles and (optionally) to fill them in a given color. Unlike BASIC's text mode, in which coordinates always range from 1 to 25 and from I to 80, graphics statements are specified directly in terms of pixels.

A pixel is simply a single dot on the screen. The number of dots you have at your disposal depends, however, on your current screen mode. For example, in the CGA low-resolution mode, there are 320 dots across the screen and 200 from top to bottom. The parameters you give to LINE must fall within the screen mode's accept-

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LINE requires at least two parameters, though it also accepts a number of useful options. Usually, you specify the starting and ending row and column positions. The starting location may be omitted, however, in which case LINE begins drawing from the last location plotted. Therefore, to draw a single line from the upper left corner to the lower right in screen mode 1,

able range of available pixels.

you would invoke LINE thus: LINE (0.0)-(319,199)

Notice that LINE assumes the first screen location to be at 0 rather than 1. This is why the pixels at the far right edge of the screen are numbered 319 and not 320. The first argument within the parentheses is always the "x" value (horizontal position), and the second is the "y" parameter (vertical position).

To resume drawing from the last location upward to the top of the screen, simply omit the starting position:

LINE - (319,0)

The most recent location plotted is established in any of a number of ways, Most of the other graphics statements (such as CIRCLE) establish the last plot position. for example. Clearing the screen always sets the location to (0.0).

LINE recognizes a number of useful options, and we'll touch on each of them briefly. In addition to determining the location of a line, you can also specify a color to be used. Valid colors depend on the current screen mode, and a complete list is given in your BASIC owner's manual. To

■ PC LAB NOTES

draw a magenta line from (0,0) to (10,10) in SCREEN 1, you add the color parameter after the x and y coordinates:

A second useful option is STEP, which tells LINE that the numbers you specify are relative rather than absolute. For example, the command

LINE -STEP(18,18)

moves ten pixels from the current location, as opposed to drawing a line to the absolute location at (10,10).

Two particularly useful LINE options are Box and Box Fill. If ,B is added at the end of a LINE statement, a rectangular box will be drawn rather than a line. Using ,BF first draws the box, then fills it in the specified or default color. The command

LINE (18,18)-(188,189), 2, BF draws and fills a magenta box with the upper left corner at location (10,10) and the lower right at (100,100).

The final LINE option is a style parameter, which is used to create dotted lines. The style parameter is an integer number or variable that is used as a hit mack to indicate which portions of the line are to be drawn. For example, to draw a line with every other dot turned on, the style value would be binary

101010101010101010

Of course, most versions of BASIC won't accept hinary numbers directly futuro Basic is a nutable exception), so you'll need to convert the bit pattern to either decimal or hex. We recommend using the hex equivalent, because it is easier to make the conversion. Further, hex permits numbers beyond the usual integer limit of 32,767 without introducing additional calculations. The binary value shown above becomes &HAAAR in hex.

CIRCLE The CIRCLE command is another important graphics primitive. While LINE is used to draw straight lines and boxes, CIRCLE creates circles and arcs. As with LINE, you must specify a starting x and y position, though in this case the reference is to the center of the circle. Likewise, you can instruct CIRCLE to use a

```
'---- PIE. WAS by Mrian Gledt
DEFINT A-H
BUREES 9
. . .
                                                      mber of date items (pie slices)
REDIM GraphDate: (N), Medianes (N)
                                                   6 pieces in this pie
Angle - 70
Argle 28 = 0
Picaise - 164
Removed - 188
                                                  'rediue of circle in pixele
'rediue of pie piece removed from pie
Ca = 302
                                                  center for # position
   - 100
Pi# = 3.1415926#
Turn# = COS(Angle * Pi# / 180)
Height - Plesise \ 1
FOR M = 1 TO M
                                                  'reed the pie chart date
     READ GrephDate: (X)
DATA 92, 78, 45, 30, 19, 11
FOR I = 1 TO H
                                                  'proportionalize pie to the
                                                      eum of its parts
     Num! - Num! + Graphbate!(I)
     Mediens#(I) = GraphDate:(I) / Num!
**** HAIR LOOP ****
FOR C = 1 TO H
     Angle10 - Angle20
                                                            'retein lest engle
     Angle20 - Angle20 + Hediene0(C) * 2 * Pi0 'celculete rediene
     AvgAngle# = (Angle1# + Angle2#) / 2
                              'this is the final slice, pull it ever from the rest
         Ca = Ca + COS(AvgAngle*) * (Hemoved - Piesise)
         oldcy = cy
         Cy = Cy - NIM(AvgAngle#) * (Removed - Piesise) * Turn#
     CIRCLE (Cx, Cy), Piesise, , -Angle18 - .0010, -Angle20, Turn0 PAngle10 - Angle10 + .0010 Pangle10 - Angle20
     IP Panalels < Pis THE
         IP Pangle20 > Pis THEN
Pangle10 = Pis
            Pennie26 = -1
     END TE
                                                  'working with the front pie pieces
     IP Pengle20 > 00 THEN
                                                  'first draw the circle
         CINCLE (Cx, Cy + Height), Piesize, , PAnglel#, Pangle2#, Turn#
         PICE - COS(ARH(PAnglels))
         P2C# = COS(ARS(Pangle28))
         PISE - SIN(ABS(PAnglels))
         P2N# - MIN(ARP(Pangle2#1)
                                                   'now draw the connecting lines
        LIME (Cx + PIC4 * Piceise, Cy - PIM4 * Piceise * Turn6) -
(Cx + PIC4 * Piceise, Cy - PIC4 * Piceise * Turn6 * Height)
LIME (Cx + PIC4 * Piceise, Cy - PIC4 * Piceise * Turn6) -
(Cx + PIC4 * Piceise, Cy - PIC4 * Piceise * Turn6 * Height)
         TR C = N THE
                                          this is the piece to pull sway from the pie
             IF Pangle16 > Pi8 * 3 / 2 THEM
CALL DoLine(CDRL(Cs + PIC$ * Piceine),
CDEL(Cy - PIN$ * Piceine * Turn$ * Height),
                       CDML(Cx), CD#L(Cy * Height))
                CALL DoLine(CDHL(Cs), CDHL(Cy), CDHL(Cs), CDHL(Cy + meight))
                PAINT (Cs + Pics + Piesize - 1,
Cy - Pins + Piesize + Turns + Height \ 2), C, 15
             END IP
```

```
Pavgangle# = (Pangle1# + Pangle2#) / 2
         PAINT (Cx + Cod(PAvgAngles) * Piesies,
Cy = 81N(PavgAngles) * Piesies * Turns + Meight \ 21, C, 15
      END IP
      PAINT (Cs + COS(AvgAngles) * .8 * Piesize,
Cy - SIR(AvgAngles) * .8 * Piesize * Turns), C, 15
      IP COS(AvgAngled) > 8 TRIN
          Lx = Cs + COS(AvgAngles) + Piccirc + 8
      KLSK
         Ls = Cs + COS(AvgAngles) * Piesise
      Ly * Cy - SIN(AvgAngles) * (Piesise) * Turns
      IP Avgangle# > Pi# THER
         Ly = Ly + Removed \ 3
         Ly = Ly - Piccisc \ 7
'SINCLUDE: 'DoLine.eas'
                                                                                                           (PIE.BAS ends)
'CAR BAR by Brian Glodt.
DEFINT A-E
PI: - 4: * ATM(1:)
DIR A(200), B(200)
DIR RoadLine(3), R(500), 8:
CINCLE (4, 4), 2, 3
CINCLE (4, 4), 1, 3
GET (1, 1)-(8, 8), B
FUT (1, 1), B, XOR
                                              'draw wheel
                                              'draw spokes inside wheel
'capture wheel and put into 8 array
                                               ereses it from the erreer
LIME (21, 38)-(28, 38), 3: LIRE (34, 38)-(36, 36), 3

LIME -(36, 25), 3: LIME -(31, 25), 3: LIME -(33, 23), 3

LIME -(24, 23), 3: LIME -(28, 25), 3: LIME -(11, 27), 3

LIME -(16, 38), 3: LIME -(15, 38), 3
                                                                                    'draw car outline
CIRCLE (18, 31), 4, 3, 8, PII
CIRCLE (31, 31), 4, 3, 8, PII
                                               'wheel hub
PAINT (25, 25), 2, 3
LINE (25, 25)-(20, 20), 1, SP
                                              'paint the car body red
'paint the window cyan
FUT (15, 28), B, XOR
FUT (28, 28), B, XOR
GET (18, 22)-(38, 33), A
                                              'place wheels on the car
                                              'cepture first image of the cer
PUT (15, 28), B, XOR
PUT (28, 28), B, XOR
PUT (15, 29), B, XOR
PUT (28, 28), B, XOR
                                              framone wheels
                                              'place the wheels one line below the position
                                                 used before
                                              'cepture second image of the car at one
 GET (10, 23)-(30, 34), B
                                              ' pixel helow where it was capture before
this provides the bouncing effect, while
the wheele elways stay on the ground
PUT (18, 23), B, XOR
                                              'erece estre image from the screen
LINE (12, 00)-(0, 110)
                                              'cepture a line at the angle of the road
GET (8, 88)-(12, 118), R
LINE (6, 94)-(310, 94)
LINE (8, 130)-(310, 130)
                                              'draw road
'PAINT (310, 100), 1, 3
                                              'optional to paint road white
RoadLine(1) = 30
RoadLine(2) = 130
   oedLine(3) = 230
                                              'place lines across the road
POP 7 # 1 PO 1
    PUT (RoadLine(I), 94), R. XOR
LINE (0, 60)-(12, 66), 2
LINE (12, 60)-(12, 94), 2
                                              'draw brick wall at the end of the road
```

pend on the current screen mode.

As with LINE, the x and y center may be either relative or absolute. That is, (100,100) places the circle's center at pixel location (100,100), while STEP (10,10) puts the center ten pixels below and to the right of the last point specified. Notice that for circles, the last point is at the circle's center, not on its circumference.

In addition to indicating the center of the circle or arc to be drawn, you must slow, provide a radius, Portions of a circle are drawn by giving an optional starting and ending location. Although most programmers would probably prefer to specify the start and end points in degrees, they must instead be given in radians. Thus, to draw the upper left protino of a circle in magenta at (100,100) with a radius of 50, you would use

CIRCLE (100,100), 50, 2, PI / 2, PI

(This assumes that pi has already been defined as 3.1415926.)

A particularly useful option with the

"Rybineous y deetin option with order who only an arc, but also the lines needed to create a pie-wedge shape. By adding a tendency of the state of t

The final CIRCLE option is aspect ratio, which allows you to create an ellipse or irregular are. If the aspect ratio is less than 1, then the circle or are is drawn wider than it is high. Likewise, if a number greater than 1 is given, it will be tall and narrow. The examples below will serve to illustrate this.

CIRCLE (50,50), 25, 2, , , .5 CIRCLE (100,100), 25, 2, , , 2

Again, both the allowable x and y values and the radius depend on the number of pixels in each direction for the current screen mode

PAINT The CIRCLE statement does not have the fill option that LINE provides, so the only way to color the inside of a circle is to use PAINT. In its most basic form, PAINT colors an area with a specified col-

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LINE (12, 94)-(0, 130), 2 PAINT (0, 113), 2, 2 LINE (12, 00)-(0, 116), 0

T = 200

SUB Pause STATIC

DEF SEG = &HB800

NEXT

■ PC LAB NOTES

or. Rather than provide outline dimensions for the area, however, you instead tell PAINT to begin at a particular location and continue coloring the screen in all directions until it encounters a border (which may be a color) or the edee of the screen.

may be a color) or the edge of the screen.

The example below first draws a magenta circle, pauses until a key is pressed, and then paints the inside light evan.

CIRCLE (188,188), 58, 2 WHILE INKEYS = "": WEND PAINT (188,188), 1, 2

The arguments in the PAINT statement above tell BASIC to use color 1 for painting but to stop when a border color of 2 is encountered. Being able to specify a border color is the all-important key, as it allows painting to be contained within any given area.

But PAINT can do much more than simply fill an area with a single color, as we are about to see. One of PAINT's most powerful features is its ability to do tiling.

TILES Tiling is a technique in which a repeating pattern mather than a solid color is drawn. Tiles in graphics look rather like these used to extend a regular pattern on these used to extend a regular pattern on the pattern of the

For the 640 by 200, two-color mode (SCREEN 2), the display is organized as 80 bytes across by 200 lines down. This makes a total of 16,000 addresses. Since there are only two colors (black and white) in this mode, only 1 bit is needed for each pixel on the screen, and each byte (8 bits) can handle eight pixels. Thus, 80 bytes are needed to hold the black or white information (values of 0 or 1, respectively) for 640 pixels.

With the 320 by 200, four-color graphitood (SCREEN 1), each pixel may be one of four colors, rather than only two. The 8 bits in each byte can represent only four pixels on the screen, since 2 bits are needed to accommodate each of the four

```
WHILE T
                               'while car is still on the road
   PUT (T, 188), A, NOR 'place first image of the car
CALL Roadlines(I) 'move one of the roadlines
     CALL Pause
CALL Roadlines(I)
                            'pause hrisfly
                             move another roadlin
   FUT (T, 100), A, XOR 'ram
                                 ove first image of the car
   'notice nothing is done while the image is off acrean
FUT (7, 188), B, XOR 'place second cer image (car is reised above ground)
     CALL Roadlines(I)
                            'move one more of the roadlines
     CALL Pause
                            'pausa again
     CALL Roadlines(I)
                             move another roadline
   FUT (T, 100), 0, XOR 'remove second image of car
   T = T - 61
                     'minimal calculations done while image is off the acreen
   SI - SI + .1
                     'accalerate
PUT (T + St, 100), S, XOR
                                'put image back on acreen to show crash into well
                                'crash noise
```

```
FOR T - 188 TO 58 STEF -1 'Crash noise
SOUND T, .2
SOUND 12767, .1
KEXT
```

RoldTime: - TIMER MILE TIMER < NoidTime: + .01 MEMO ENG UUS

SUB Noadlines (1) STATIC SHANDO Roadlines(), R(), S: SUT (Roadlines(1), 94), N, XOR Roadlines(1) = Roadlines(1) = 8: IF Roadlines(1) = 15 THEN Boadlines(1) = 5

IF ROBELLINA(1) > JUSTICE ROBELLINE(1) = 5 PUT (ROBELLINA(1), 94), R. sout I = (1 NOD 3) + 1 soumb 100 + (8: * 8), .2

(CAR BAS ends)

'CGA display memory segment

SCREEN 1

X = TIMER
WHILE X + .5 > TIMER
'allow screen time to settle
WEND
FOR X = \$ TO 15999
FORE X, 255

'turn on all pixels in succession

Figure 1: FILL.BAS provides a visual example of graphics memory organization on a CGA adapter.

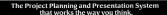
possible colors. Thus, the same amount of display memory (16,000 addresses) can bold only half as many pixels.

80 through 159 are held instead in the address range from 8192 to 8271.

Running the program FILL BAS.

In the text modes, successive characters shown in Figure 1, will provide a visual on the screen are contained in successive example of how consecutive bytes in bytes in display memory. In the CGA memory are related to the dots on the CGA modes, however, a technique known as inscreen. The FOR/NEXT loop fills contigterlacing is used to arrange the screen uous memory locations, but the screen immemory. When interlacing is used, while age is drawn in two groups-all the even screen locations 0 through 79 are conrows first, then the odd. Notice that the tained in addresses 0 through 79, locations display adapter really holds 16,384 bytes

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■ PC LAB NOTES

for each screen. Thus, the second memory block actually starts at address 8192 rather than at 8000. (The 384 extra bytes are not used.)

The third screen mode to examine is 640 by 350. It is used with an EGA in SCRIEN 9. To accommodate this resolution, 28,000 bytes are needed to represent all of the pixels, but even this much memory can describe only a two-color screen. Since 16 colors require four times this amount of memory (4) bits can designate any value from 10 to 15), the EGA sedsign-

ers had to come up with some way to squeeze that many bits into the PC's limit-

ed address space.

The technique used with an EGA is known as bank switching. The same memory addresses are used for each of four separate banks, or planes. One memory bank to the same of information of the bank component of each screen location, and two more hold the bits or real and two more hold the bits for the significantion, see the sidebar for further explanation, see the sidebar for further explanation.

"Bank-Switching the EGA.")

As mentioned earlier, the patterns that will be used for tiling are contained within al BASIC string. And since strings are comprised of bytes, there's a natural parallel between the bits in each character in a string and the bits (pixels) on the graphics

 Bank switching is used with an EGA to squeeze enough memory for 16 colors into the PC's limited address space.

BANK-SWITCHING THE EGA

In an EGA display adapter, four sepatrate memory planes are used to hold the red, blue, green, and intensity information for a graphics screen image. In screen mode 9 each plane contains 28,000 bytes, for a total of 112,000 ad-

But the PC simply does not have that many addresses available for display purposes. Therefore, each plane must be assigned to the same physical addresses, which means that only one of them may be active at a time. A program indicates which plane is to be addressed by sending values to the EGA's hardware ports.

Normally, you won't need to manipulate video memory on a byte-by-byte basis. After all, that's what high-level languages are for. However, it is necessary, if you intend to save and load images on disk or to use PEEK and POKE, to access display memory directly.

Fortunately, the BASIC INP and OUT commands provide a simple way to access hardware ports. A sequence of two OUT statements is needed to switch planes. The first OUT simply gets the EGA's attention, and the second provides the actual command.

Vides the actual command.

The two short programs in the listing EGABSAVE. BAS (Figure A) will seen and load a high-resolution EGA screen from BASIC, using four separate files to hold each memory plane. Notice that the statement DEF SEG = &HAQQOI is needed to indicate which segment BASIC is to use for the BSAVE and BLOAD commands.—EHAM Wirer

screen. The only real complications arise from the many possible graphics modes and the corresponding variation in resolu-

In SCREEN 2 (640 by 200, two-color), the PAINT command expects a tile string that is 8 bits wide and up to 64 bytes long. Each bit controls one pixel. The tile string should not be padded with spaces, of course, since spaces would be interpreted as being part of the tile pattern. (A space has a bit pattern of 00100000.)

With SCREEN 1 (320 by 200, fourcolor), on the other hand, each screen byte can handle only four pixels. Thus, each character in the string will hold the pattern for four consecutive pixels rather than eight. In this case, the first 2 bits in the byte control the color of the first pixel, the next 2 set the second pixel, and so forth.

The diagram "Defining Tile Strings" shows the transition (in SCREEN 2) from the desired tile pattern, through conversion to binary numbers, and finally to the appropriate CHR\$() bytes in the actual tile string.

In the 640 by 350, 16-color EGA
In the 640 by 350, 16-color EGA
wide. Here, a tile string may be up to 350
bytes in length, though it will be organized
somewha differently. In this case, the first
byte corresponds to the first color plane,
the second byte to the second color plane,
and so forth, continuing through the intensity plane.

```
'----- BSAVe an EGA graphics screen
DEF SEC = KHA898
OUT 6H3CE, 4: OUT 6H3CF, 6: BSAVE "Blue", 0, 28800
OUT 6H3CE, 4: OUT 6H3CF, 1: BSAVE "Green", 0, 28800
OUT 6H3CE, 4: OUT 6H3CF, 2: BSAVE "Red", 0, 28800
OUT 6H3CE, 4: OUT 6H3CF, 2: BSAVE "Bright", 0, 28800
OUT 6H3CE, 4: OUT 6H3CF, 3: BSAVE "Bright", 0, 28800
```

'---- BLoad an EGA graphics scree

DEF	SEG = &H	IA	888				
				&H3C5,1			
				&H3C5,2			
				&H3C5,4			
					BLOAD	"Bright"	
CHT	£H3C4.2		OHE	£H3C5 15		-	

Figure A: EGABSAVE.BAS uses the OUT command to activate each EGA memory plane.

■ PC LAB NOTES

The fifth byte then corresponds to the first color plane of the second group in the first color plane. This reasons that the strings intended to be used with an EGA generally will have a length that is a multiple of 4. Thus, if a string is 5 bytes long, for example, BAS Creasth set brings as if it had been padded with CHRS(0) null characters to a length of 8 bytes. As you can see, defining tile patterns for the EGA screen modes can cuickly become very tedious.

■ Because PAINT uses the border color you specify to know when to stop, any breaks in that border will cause the painting to leak out.

Having created a tile string, however, let's each ow eve and put it to use. While let's each ow we can put it to use. While let earlier PAINT examples used a numeric value or variable to indicate the paincolor, tilling instead uses a string argument. The example below will fill the entire screen with the heart tiling pattern described in the diagram "Defining Tile Strings."

[Both QuickBASIC and Turbo Basic concatenate lines that end in an underscore followed by a carriage return.—Ed.] Of course, PAINT can be used to fill an obiect, as well as the entire screen:

One important point to observe when using PAINT to fill an object is that the border surrounding the object must be continuous and a single color. Because PAINT uses the border color you specify to know when to stop, any breaks in that border will cause the painting to leak out. In the example below, a second LINE statement is used to erase a tiny portion at the top of the box by drawing in black (color 0).

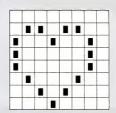
SCREEN 2 LINE (50,50)-(150,150), 3, B LINE (100,50)-(102,50), 0 PAINT (100,100), Tile\$

Note that hidden lines can interfere with the PAINT command if they are of the same color as the border of the object to be painted. (See the sidebar "Hidden Lines in BASIC" for a fuller explanation.) The first example in Figure 2 shows how PAINT will stop when it encounters the "hidden" dividing line, while the second

example continues to fill the box.

Because PAINT will be interrupted if the border color specified is the same as that previously used for drawing, you may want to consider reserving one color for a border. The program CIRCLES.BAS (Figure 3) shows how multiple circles can be created by drawing the outline of the circle first, then filling it with the desired color, and finally redrawing the first circle in the same color used for the fill. If you omit the second circle command you will see the effects of what should have been hidden lines. This technique is not limited to circles or squares, of course. Any object that can be drawn once could be drawn a second time, at the same location after a PAINT command has been executed.

Defining Tile Strings



Binary	Hexadectmal	Decimal		
00000000 =	&H00 =	0		
01101100 =	&H6C =	108		
10010010 =	&H92 =	146		
10000010 =	&H82 =	130		
10000010 =	&H82 =	130		
01000100 =	&H44 =	68		
00101000 =	&H28 =	40		
00010000 -	&H10 =	16		

Tile\$ = CHR\$(0) + CHR\$(108) + CHR\$(146) + CHR\$(130) + CHR\$(130) + _ CHR\$(68) + CHR\$(40) + CHR\$(16)

The PAINT file string for this heart pattern is composed of a series of bits, each of which represents a single pixel.



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■ PC LAB NOTES

GET AND PCT Two of BASIC's most powerful graphies commands. GET and PUT, provide the fundamental tools for animation. GET captures a portion of the graphies screen and copies it into any that you specify. PUT does the opposite placing the contents of an array as a graphical representation onto the screen. Bear in mind that PUT can restore an image to any location on the screen, not only to the place from whence it originally came.

A kind of animation could be achieved by using multiple LINE statements. With such a technique, however, the time required to draw and erase each line would

become prohibitive for complicated images. Because GET and PUT simply copy memory from one location to another, they can operate much more quickly.

When the GET statement is used, BA-SIC fills the specified array with the bytes from display memory that correspond to the portion of the screen heing saved. GET also stores the width and height of the saved image in the first 4 bytes of the array. The remaining portion of the array

The organization of the data depends on the video mode from which it was retrieved, but in general, screen data is

stored from left to right, then from top to bottom. However, if the image was captured from an EGA or VGA screen, VGA screen, the left-to-right copying will proceed through each of the color planes before moving on to the next line below.

The PUT command provides five options for placing data onto the screen: PSET, PRESET, OR, AND, and XOR. We'll restrict our attention here to the PSET and XOR options, as PRESET, AND, and OR have fairly specialized uses, PRESET creates a reverse image of a picture. AND and OR combine the colorcurrently on the screen with those saved in

HIDDEN LINES IN BASIC

6.6 Hidden' lines are simply those solid figure, should not be seen. Of the many way to create simply the seen. Of the many way to create simply drive those portions of the object that are furthest from the viewer first. Then, as the images that are to appear closer are drawn, they will hide what had been created earlier. For example, in a picture of a person standing in front of a car, you would first draw the car, and then the person.

In the program fragment below, a solid box will be drawn in front of a slanted line:

```
SCREEN 1,8
LINE (50,50) - (150,150), 3
LINE (80,80) - (120,120), 2, BF
```

Because the box was drawn after the line was, the line is hidden. Unfortunately, however, this approach is not reliable when you are using the PAINT command to fill a foreground object. Where LINE with the Box Fill option will always fill a given area completely, PAINT stops whenever it encounters a line or other obstruction with a particular color, as shown below.

```
SCREEN 1,8
LINE (50,50) - (150,150), 3
CIRCLE (100,100), 20, 3
PAINT (90,100), 2, 3
```

to fill the circle completely, the line acts as a barrier that prevents the second half of the circle from being painted. One so-lution is to create a special routine that simulates the LINE statement but has the ability to determine which portions should be hidden and, thus, not drawn. In this way, the circle can be drawn and PAINT-cf first, and the new LINE rou-

tine will not overwrite those parts that are to be kept in the foreground.

The subprogram DOLINE.BAS (Figure A) and its example below do preciseby this. DOLINE begins by calculating an appropriate increment for the line, based on the starting and ending locations to be drawn. It then plots each required pixel, one by one, but only if the

```
SUB DoLine (X1#, Y1#, X2#, Y2#) STATIC
   IF ABS(X2# - X1#) < .01 THEN
                                         'calc slope of line
       My# = SGN (Y2# - Y1#)
                                         'based on configuration
       Hx# = 8
                                         of the end points
       M# = (Y2# - Y1#) / (X2# - X1#)
       IF ABS(M#) > 1 THEN
          My # = SGN (Y2# - Y1#)
          Hx# = SGN(X2# - X1#) / ABS(M#)
       ELSE
          My# = M# * SGN(Y2# - Y1#)
          Mx# = SGN(X2# - X1#)
      END IF
   END IF
DrawPixel:
   IF POINT(X1$, Y1$) = 8 THEN PSET(X1$, Y1$) 'plot if black
                         'increment current pixel on screen
   X18 = X18 + Mx8
   Y1# = Y1# + MY#
                         ' whether or not a point was plotted
       IF INT(X1#) =
                      INT(X2#) AND INT(Y1#) = INT(Y2#) THEN _
'we reached the end of the line
           EXIT SUB
        GOTO DrawPixel
                              'attempt to draw the next pixel
   END SUB
```

In this instance, even though our intent is Figure A: DOLINE BAS is a hidden line routine that draws only where the screen is black

the array, which, more often than not, will create an undesirable effect.

1 1 1 1

When using the PSET option of PUT to place an image on the screen, the original colors that had been captured are used. Regardless of what is currently on-screen at that location, the original image is faithfully restored. To provide animation, however, we also need a way to erase the image. That is to say, if an object is to move across the screen it must first be drawn, then erased, then redrawn at a new location. This is where XOR comes into play.

Not unlike AND and OR, XOR also combines the colors that are currently on

current color is black. BASIC's POINT function conveniently returns the current color for a given position on the screen. Of course, you could modify DOLINE to recognize any color, not just black.

```
SCREEN 1,8

LINE (100, 100)-(150, 150), 2, SF

LINE (100, 100)-(150, 150), 14, B

LOCATE 25, 1
LOCATE 25, 1
PRINT "Press s key to drew the line";
WHILE INKEYS = "": MEND
CALL DoLine(8#, 8#, 488#, 349#)
'$Include: 'DoLine'
```

Rather than rely on the presence of a par-

ticular background color, an alternative approach is to calculate whether a given point should be plotted. However, this requires knowing the exact location of the object's boundaries. Many floatingpoint calculations may be needed in the case of complex graphics images, and this will slow things down considerably. As an example, eliminate the following statement in DOLINE:

IF POINT (X1#, Y1#) = 8 THEN PSET(X1#, Y1#)

and replace it with

```
IF X10 < 100 OR X10 > 150 OR
Y10 < 100 OR Y10 > 150 THEN
    PSET (X1#, Y1#)
```

When you run the example program, the results will appear to be the same, though if you move the box it will no longer work.-Brian Giedt

the screen with the image that had been saved in the array. XOR is unique, however, in that it uses the difference between the color bits. Any bits in an image that are XORed with other bits will be reversed from what they had originally been. Then if the bits are XORed once again, they will

be restored to their original state. Thus, if a picture is PUT on the screen with XOR twice in a row, it will be erased the second time. Further, any other images that were originally on the screen but overwritten will be restored as well.

ANIMATION IN ACTION Using the XOR method to achieve animation is effective for small images-those that occupy fewer than about 3,600 pixels (60 by 60). At a point somewhere beyond that range, however, the animation slows down dramatically. This is because of the need to interpret the video colors, XOR them with the new values, and place them back onto the screen.

Worse, BASIC must exercise the XOR function twice in order to move an image: once to remove the old image, and once more to place the new one. PSET is therefore much faster, because the image captured by the GET statement may be directly transferred to the screen without regard to what is already there.

In the listing ANIMATE.BAS, shown in Figure 4, GET is used with PSET to move a small box across the screen. As you will see, however, it leaves a trail as it

moves While the effect created by leaving parts of an image on the screen can sometimes be used effectively, it really isn't wanted in this program. It is possible, however, to eliminate the leftovers by capturing the image with an extra margin. For this to work, the width must be equal to or greater than the maximum movement in the direction of interest. That is, if the image being animated is to move four pixels at a time, the portion to be captured must be at least four pixels larger than the original image.

To eliminate the image trail, then, add this program statement immediately after the first LINE statement-

LINE (4, 12)-(12,48), 1, BF Then replace the GET command above with this new version:

```
GET (4, 12)-(48, 48), A%
```

The one immediately obvious problem is that this method can overwrite more than it was supposed to. Thus, you must be sure to make the boundary only as large as is necessary.

```
SCREEN 1.0
LINE (30,30)-(170,170), 3
                                 'draw white diagonal line
LINE (50,50)-(150,150), 3, B
                                 'draw white box
PAINT (98,188), 2, 3
                                 'attempt to paint box magenta
SCREEN 1,8
LINE (30,30)-(170,170), 1
                                 'draw cyan diagonal line
LINE (50,50)-(150,150), 3, B
PAINT (98,188), 2, 3
                                 'paint entire box magenta
```

```
Figure 2: PAINT fills an area until it encounters a specified color.
 DEFINT A-2
SCREEN 9
 WHILE INKEYS - **
                                                   'continue until e key ie preseed
     X = RND * 640
Y = RND * 350
                                                   'rendom X center
'rendom Y center
'rendom redius
     Redius = RND * 100
     C = (C HOD 14) + 1
                                                     increment C from 1 to 14 then back to 1 equin
     CIRCLE (X, Y), Radiue, 15
PAINT (X, Y), C, 15
CIRCLE (X, Y), Radiue, C
                                                   'drew circle in white
'fill to boundaries of the circle in color C
'redrew the circle in color C
```

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■ PC LAB NOTES

USING XOR Even though XOR lets you draw and erase images very quickly, it often requires more-careful planning than PSET if it is to be used effectively. In addition, the order in which you draw and re-

move an object depends upon the situation. For example, if the first occurrence of the image is erased before the second is drawn, there is a risk of creating flicker if there is no background color.

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CIRCLE 729 ON READER SERVICE CARD

SCREEN 1, 0 DIM A9(400)

LINE (12, 12)-(48, 48), 2, BF GET (12, 12)-(48, 48), A*

LINE (0, 80)-(250, 160), 1, BF FOR X = 18 TO 288 STEP 4 PUT (X, 188), At, PSET T = TIMER

WHITE T + . 61 > TIMER: WEND

Figure 4: ANIMATE BAS illustrates the use of PUT with PSET to move an object.

In general, then, a better approach is to draw the object, then draw it again in its new location, and finally erase the original. At the point where both images are on the screen, there will be some color distortion at the points where they overlap. But the distortion will be very brief, and it will disappear as soon as the first image is removed. Keeping color on the screen at all times creates much less flicker, which in any case occurs only at the point where the two images overlap.

As with many endeavors, the best ways to master graphics programming are to study the techniques and approach of other people's programs and to experiment with your own

Two complete programs, CAR.BAS and PIE, BAS, have been presented here in order to provide examples of advanced BASIC graphics techniques, as well as illustrations of many of the commands that are described in this article.

CAR BAS animates a car moving across the screen on a road while bouncing up and down. At the same time, the road is also moved, but in the opposite direction. CAR illustrates the effective use of XOR, together with a number of other interesting and clever programming techniques. PIE .BAS is a complete three-dimensional pie chart program that incorporates both perspective and the elimination of hidden

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COMPARE SIMPLIFIES FILE MATCHUPS



COMPARE.COM takes the time and tedium out of finding the differences between two versions of either text or binary files, even when they have different lengths.

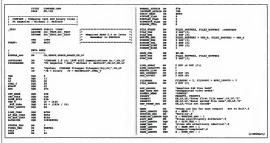
When you've got two versions of the same document, how can you quickly find the differences between them? If your first thought is to use the DOS COMP utility, you've probates the properties of the same exactly the same length. COMP won't conclude it to case it. If two tiles aren't exactly the same length, COMP won't work to be a compared them. And you first compared them, and you first compared them when the properties which it reports in a disordenting hexacle-imal format that assumes your files are binary executables.

What I wanted was to compare the original drafts of the articles I write for this column with their edited versions. The editing process catches more than gross mistakes, like the all-too-easy misuse of apostrophes in "it's" that drives grammar fanatics crazy. Good editing also introduces subtler

zy. Good editing also introduces subtler changes that eliminate ambiguities and prevent possible misunderstandings the author did not articipate. Unlike old-fashioned blue-pencil edits, however, the emendations made electronically with a word processor are invisible. So if a writer it

is to improve his craft by learning from what his editors do, he needs a program to show him what those editors did. COM-PARE.COM is my solution.

COMPARE COM does what I think a practical compute program should do. It presents both documents simultaneously in on-screen windows, with only the intovidual differences highlighted. Differences between the two files are preceded with a few lines of the matching text to provide context. To make it a complete utility, it can also do binary compares for those co-



UTILITIES



casions when you want to compare executable files. But above all, it is not confused by word-wrapped text.

This last requirement eliminated the existing compare utilities I've seen that work with text files. These all emulate the UNIX DIFF command, which compares files by lines. That's great for comparing program source files, since most compilers digest source code a line at a time. But a modem editor will almost invariably use a word processor that implements word wrap and restructures the copy while editing. With word wrap, a single word deletion or insertion can create a ripple effect that runs through the entire paragraph. This will confuse a line comparer, causing it to report that all the lines from the change to the end of the paragraph are different. Indeed, if a single change were made to each paragraph, a line comparer could conclude that the entire document was different! Thus, COMPARE.COM was designed not only to point out differences within a line, but also to be word-wrap aware.

You can obtain a copy of this program most easily by downloading it directly from PC MagNet, as explained in the accompanying sidebar "COMPARE by Modem." The source code, COMPARE .ASM, and a BASIC program (COM-PARE BAS) that will automatically create COMPARE.COM when you run it once are printed here and are both also available from PC MagNet.

The syntax for using COMPARE is COMPARE filespec filespec[/B][/W]

files. COMPARE can digest non-ASCII elements in a file (for example, word processors' formatting commands for headers and margins and special character sequences that control saved cursor position and soft carriage returns), but it can't use them to control the screen display. For the purpose at hand, this should not be a major

If you do encounter difficulties from any word processor formatting commands, bear in mind that most of the word processors that might cause trouble also have some kind of export or save facility that produces a straight ASCII format. With one prominent case in mind, I built in the optional /W switch, which instructs

 COMPARE.COM was designed not only to point out differences within a line, but also to be word-

wrap aware.

COMPARE to strip the high bit before doing a compare on WordStar document files so they will be displayed in normal ASCII characters. Figure 1 shows a sample of COMPARE's text output.

The optional /B switch forces COM-By default, COMPARE assumes that PARE to do a binary compare on the two

files. As shown in Figure 2, the mismatches in a binary compare are displayed in a hexadecimal format similar to that of DEBUG. There are a couple of slight differences between COMPARE's and DE-BUG's output, however. For one, in the right-hand column, DEBUG substitutes a place-taking period for any nonalphanumeric character, COMPARE, more helpfully, displays each byte just as it appears in the ASCII symbol table. Further, COM-PARE's segment offset starts at zero. whereas DEBUG uses the segment of the memory location and an offset starting at 100h. COMPARE is intelligent enough to do a binary compare automatically on .COM and .EXE files; for these, you don't have to remember to use the /B switch. The /B option enables you, however, to instruct COMPARE to do a binary compare on any file you choose.

COMPARE will automatically help you if you misremember its syntax or misspell either of the filespees. If you enter the syntax improperly, the proper syntax will be displayed. You will also be prompted for missing filenames. Once two filenames have been accepted, two windows are opened and a "Working" message appears at the bottom of the screen while COMPARE goes about its business of looking for differences. Differences are displayed in reverse video. Both windows are filled with contiguous text, starting with a couple of lines prior to the highlighted mismatch, so you can see the differences in context. Press any key and COM-PARE will search for the next difference.

When you've seen enough, pressing

PRODUCTIVITY

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		197,2 187,3 CAP	jeest filaspec.	1021	ENDP		
	JA	AL, CD	(Man last character person (S)	;	. 520	COTTRAX *	
	JWS	AL.CS MAT PARSE PROMPT USES MOORT GOOSE START	Has last character persed CEP If no, get mest. Plas prompt user for filesper sed stars pointer to it.	i	******	********	
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1					36597	DIMPLAT_PLAC, 0	:We display during search.
NIADT+	MOV.	LINE ARRAY(C), AN	Initalize current line-starts of array to start of file.	; Check to as	e if End	of file has been yearbe	d and/or windows have been fill
	90V 90V	LINE ANDAY[6] AN AN, File HEAVY[2] LINE ANDAY[14], AN		1			
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UTILITIES

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CK_ADJUST_2A+ ADJUST_2A+	CHP JE KOR	AX, SPACE FORMAT BOTH BP, SP	Ino the same for other file.		POOR HOV CMAS	CK CK, 1 CM_DISPLAT CK_DISPLAT	:fave column. :Elaplay coe character.
PORMAT POTES	2007 2008	SHORT PONNAT_IN			POP DEC PET	CX.	Restore column and decrement.
PORMAT_LA.	HOW HOW CALL	PORMAT SP, 2 AL, AZ PORMAT	:Pile two index.	EXPARI_TAX:	POSE DEC APD	CE CE CK.7	;ieve column. ;Adjust column couster. ;ost bettom thrms bits.
DO MESMATCH:	300	HISTORY FLAG. 1	I in AL. Check mext bytes.		IRC	CX CE PAD SPACES	padjust.
-	THE CMT	WEST STARCS	:Plag that mismatch found, :Go highlight the mismatch. :Check must bytes.		CALL POP EV6	CI CI CI, AX	radjest column counter.
PEACE ESO:	RET			PAD SPACES: CH DESPLAY:	HOV CHP	AL, SPACE	:If CW display spaces.
				COMME.		PISPLAT SED WISDOW TIME(89), 9	ilf so, reture.
AL - Chart 69 - Inde	cter to	format.		MATER ATEN	CMP CALL LOOP	AL, STACS DISPLAT FLAG, 1 DISPLAT FLAG WISCON TIME (SP), S DISPLAT SEG DI, WINDOW POOL (SP) WRITE SCREEN WRITE VIEW WRITE VIEW WRITE VIEW	; if yes, retern, ; slee, retrieve display position ; write character CE times.
WINDOW_PUT	[67]	INDOM LINE DO:		DISPLAY END: LINES END:	NOV NOR NOT	ex,cx	office new display position.
		d BI preserved.		LINES	ENDP		
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	PUBR	AR CR EI	:Preserva registers.	1 SP = Index	te fil	m. ;	
	PUSH PUSH HOV CHP	ST DI CE, WINDOW COLUMP; LINE CAPACITY, 16 DO MÎZ LIÑES	:Retrieve correct column.	CE - new c	rolumn. I(SP) le	updated.	
	CMTT CMTT	DO HÎZ LIÑZS SSONT CE LINS STRAY	iare we working me a binery file? iff yee, do a has display. itles, display test lines.				
10_8EE:	CMT	MEZ		NEX	7900 CNR	PERSONAL PLANS, 1	
IN_LISE_START	JCKE BEV JNP	PILE POSISFI LISS START WINDOW COLISPICE SHOOT FORMAT_SED	Increment file position. Eard of a display lime? If no. atca column postico and reture.	DRC COCUME	CHP JHE JHE DEC HET	PIRPLAT PLAG, 1 DEC COLUMN WINDOW LINE(BP), P GO REE CE	pare we to write to mercant plf no, just update column. ptime, is window full? plf yes, continue. plies, update return and retu
INE_PEART	HOV CRP	AR, LINE CAPACITY WISDON COL(SP), AX AR, 16	:Else, go to next column. :Are we doing a binery compare?	OO HEE	*****	a	place arms registers.
	OR JPI CALL	CH ABOAT BP, SP CE CH2 CE DOF1	pare we doing a binery compered of yea, skip CK chack. pales, check if ECP.		PUBR	AN CX	
ca cate	CALL	CK_EOP2			CHP JVE POSA PVSS	CX,16 DISP SUMMENS AN	;Retrieve window position. ;10 It first calmer ;1f oo, just display the byte ;2les, seve character end ; attribute.
ca_car	CHP	CE JUST DI, FILE FOR: SP! STIR PTR DI , CR CS JUST PILE FOR: SP!	pif EOF, akip CM wheek. piles, if byte et and of an SP prolumn display is cm, bump pille postion past it so pident double apare display.				; attribute. :Retrieve file position
CE_ARRAY:	CHP JVI CHP		don't double apare display.		ADD PURE HOW	AX, PILS POS (SP) AX, PILS STATT(SP) AX, MEX_DOPERT(SP) AX AX, MEX_SEMENT(SP) DISP_SEMENT AX, 1988)	;Retrieve file position ;Subtract the startles positi ;Add the 46s offret. ;Eare the offset. ;Earleve edgest. ;Did offset Carry? ;If yes, add 1890 to sequent
	23 084 291	DISPLAT FLAG, 1 ADJUST ARRAY WORDOW LINE RP; 8 PORDAY END BESTON LINE RP; ADJUST ARRAY	prise, is window fully off yes, done here.		ANO		illd effect derry? ilf yee, edd 1880b tz segment
	ADD OR		lars we displaying? If no, attp lins sheek. Itle, is wishow full? Itle, is wishow full? Itle, is wishow to list. It window not full, akip nest. It window not full, akip nest. Itle, nest appropriete I wracow rull bit as full.	NEET_ACCRESS:	ECRO HOV HOV	ER, SORMAL ATTRIB CK,1 AN,AL DISPLAT SER	;Tea mormal attribute. ;Repeat and offset occuter. ;AL = byte to display.
	782 782	WINDOW FULL, CL. SMORT FORMAT_ENS			ECMO	AR, AL	jost second byte to display.
ADJUST_ASSATI	CALL	POSSAT ESD ASPAT TROOK			OR HOW CALL	CE, CE ACONTES END AL, "1" WAITE_SCREEN	imagement and offset displayed if yee, done here. iflee, display delimiting cal
	AGD MOV MED	81,01 41,2 cx,3	;Move all lime starts up one		POP DEC JUP	AX CX EMONT HEXT ADDRESS	Notriave offset. Decrement counter. Display sequent.
CONT_DOD.	909 909 909 909	AN, PILE POD(SP) DI), AN DI	: and store new line start. :Restore requeters.	ADDRESS_END:	ADO POP POP	DI,4 6E AR	Nove right two spaces. Satriave attribute. Satriave character.
	ART	AN .		OTEP_ROMBERS	CALL HOW POP CHIP	DISPLAT NEE AL, SPACE CE	pliantly the bem number. publish with a speca. patriove column courter. In it helf way?
TOPPAT	10494				JYS HOV PURE	CH.9 DELIMITES AL.	ple it belf way? plf yes, display delimiting d p with sermal sttribute.
AL - Chare CE - Chare DF - Inde	cter to	display.		BELDETTER	MOA	AN STREET, ATTREE	
OUTPUT		•			POP 2007 ENG. ENG.	MIRDOW_POSIMPI, DI CX,1 CX,1	Reaters stiribute. Etora window peakties. Hultiply column by 8.
CE - new C	(BF) is	updated.			ADD ADD POP CALL	DI, CE DI, 38	;Add to current wiedow postle ;Tab ever additional 15. ;metrlave character and displ
. INES	PROC	WAX.			POP BEG JHS HOW	MATTE_SCHEEN CX CX	:Restors column counter ; end update. :If lest column, bump window ; to mest line.
	25 26 26	AL, CB PAD SPACES AL, TAS	Carriage return? If yes, ped balance of line. Its it to character?		909 808	MEX BHD AX, COLO AX, 59	
	- The	man a Mil	THE AL CHE CHEROCORY	I i			(COMPARE ASM continu

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strate" a point

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■ UTILITIES

	AUD BET	AN, 1 MINDOW POS[SP], AN		1	Jan	SHORT WEST_SYNC_END	; east file 1 postion.
MEX_MODE	RET			MENT_TET_END:	POP LOOP	CE PERT_TET	Increment file 2 postion. Decreacet reach counter. Reep trying up to 488 position
18PUT AL - bee r		dinte		MEXT_STRC_EMO	POP LOOP	EX CX HERT STNC	Increment file 1 position. Decrement reach courter. Deep trying up to 488 position
OUTPUT					2022	BI .	isere pointers.
8000		1			2058		rases permers.
BX and CX	pressre	et.			MOV MOV	SI, OFFEST DIFF MOS DI, STATUS LINE AN, COLS	
HEPLAT BEX	***	was.				AN, I AN, DEFF_LEMOTH + 2 DE, AN	
	POSE	cs	Preserve CX.		215 A20 P166		
POTATE_REE:	ROL FORE	EX, #28440	Preserve CX: 2 char/byte; 4 hits/byte. Cut east four hits. East comber: Heat off high bits. Convert to AMCII: Is it above 97		POER HOV CALL	DE BE, MORRAL ATTREE	Display "Files significantly different" if didn't find
	ARD		Have conter.		CALL	METTE_BTETES	; a metch.
	ARD ARD ORP JUE	AL, 386	Convert to ABCII.		POP	2.2 0.0	
	ACC CALL	PRINT_MAX AG,7 MRITE ACRES	IIf yes, convert to hee eighe.		700	ST STATUTE FOR	
PAINT_MEE:	POP	MATER ACRES	Restore runber. Do both hee cheracters.				,
	POP DEC JUE POP	CR BOTATE_BEX CX	100 both hee cheracters.	James and	uteh co	nii Rof er window full.	
DISPLAT_NIK	ENDP			EVALUATE EOF	POP	CE SOPI	price stack.
TAPUT				P0F2+	SOV GALL	CE ROPI ENFI BILFILE EGO(#) CE EGO/2 INVENE	:If yes, ose file end pointer.
1 36 - Diepl	sy ettr	ibute.		Barz.	JEC	DAMESON.	
OUTPUT		1		terme:	MOV MOV MOV	DELFILE EMD(2) BYSC POS(8(,82 SYSC POS(2),08 SS, INVENS_ATTRIB	plf yee, use file end pointer. place sympheterisetion position.
All renies	ere des	armed.					;Olepley in leveree sttribute.
				RDONLDONT:	MOV SOV CHP JI CHP JI	dr,2 st,PILE POS(SP) st,STMC POS(SP) LOSE INVERSE HISBOR LINE[SP],S LOSE_INVERSE	Two windows to display.
ETSHATON	PROC	PEAR			CHEP	AI, STHC POS SP LOOP INVERSE	
	CHO?	DISPLAT FLAG, 1 SYNCHROWISE	IIs this first time here? IIf yes on context to display. Sist, fisq to display. IClear the windows.		71 71	MERODE LINE SP , S LOOP INVENES	if yes, done.
	CALL	DISPLAT PLAC, 1			CMT CMT TOORS	ROOM MICHTIGHT	;Elac, display missatch.
EXT_SECONS	HOV HOV HOV CALL	SP, 2 AB, LINE CAPACTYS WINDOW TCC, SP), AB CX, PILE POO(SP) ABANT THORX AB, (ST)	Two windows. Twest or line to first column.	LOOP_DEVEROR:	900 210	69,2	yoe both windows.
	190V	CH, PILE POS(SP)	shave current position.	EVALUATE_END:	CALL	STORE NIMOW SP, 2 AX, STEC POS[SP]	Presee postion if window full.
		AM, 10E1	(Betrieve third line back.	RESTORE POST	NOV NOV	AX, STRC POS(SP)	parent correct position.
MEET_CONTEXT	MOV MOV	FILE POS(SP), AN SI, The Pos(SP) SI, CH	Display context until current selected position.		875 875	PILE POR SP LAN SP, 7 RESTORE POR	
	DAX LODES CALL	POOS ATROOM	, postcom.		RET		
	CALL	SHOW! BEST CONTEST		SESMANCE	ENDP		
POOL MARKET	390	SP. 2 HEST_WINDOW	;Se both windows.	1 18907			
,		_		Bote		;	
current poel	tice.	ny matching IS bytes up IN test files, lymore o	to 388 poetions avey from peres ac won't get felan metaben.	None			
PT#CBBOULEX:	NOV NOV	EX.PILK_POS(6) CX.460	File 1 postice is ax.	AI end 10			
4837_639C+	POER BOY BOY	er.		STORE_WINDOW		PEAR	
100 mm		0E, FILE_POS(2) CE, 480		A4 4000 40 0	window		e position for most search.
	NOA.	CI,10	News counter. Pequire 10 bytes for metch.		7687 38	NIMPOW PULL, 1188 STORE TRO	jaither window feil? If no, dome. Illes, have we sireedy stored? If yes, dome. Illes, flag stored.
	HOV CALL	61,6X	; Initialies polaters.	1	TEST	MINSON PULL, 0516 STORE END	illee, have we streety stored?
REIT_CHAR	CMT	SI, SX OI, SX CR EDFI SETT TET THO CR EDF2 FILEZ BHO	page of file one; if yes, increment file 2. sor of file two! if yes, increment file 1. petriane characters.		OR.		
	CALL	CH HÖF2 FILEZ BHO	iff yes, lacronest file 1	PREEE POOR	MOV	AN, PILE POS[SP]	(And store current position
	MOV MOV	AL, (dT) AB, (DI)			HOY HOY HOY HOY	BY, 2 AB. PILE POS[SP] SAVE POS[SP], AX AX. WESSOW COL[SP] SAVE_COL[SP], AX	; and column.
	CALL JC HOV HOV COPIA JI CHP JI CHP JI CHP JI CHP JI		:Do they match? :If yes, poss. synchrosisation. :#100, is it bloary compare?		21C	SP, I POS	
	CHP 21	POSSISCE STRC LISE CAPACITY, IA MERY TET END AL.LF ADJUST_28	ofice, is it hivery compared off yee, on match. otinc, if lincfeed, ignore.	STORE_END:	RET		
	JI	ADJUST_20		NOOSE ATMOOR	EHOP		
	71	AL, CHARTON AND AND AND AND AND AND AND AND AND AN	; If carriage return, ignore ; and ignore any match space. ;Do same chack for both files.	1 18707			
	n n	ADJUST_16	per same cases for both files.	SECUT 6I and 0I 700 sotry CK BOTT	- curre	ot pesition.	
	211 211	MANY_THT_END		CK_BOP1	and CK	Trong !	
CK_ADJUST_18:	CHP	AL, SPACE SEET_CHAR	ilf CX with space, ignore both.	Cerry fle	:1#	nor.	
ANJUST_18:	DEC	STORY MENT CAME	:Biee, ignore CK only.	SP destro			
CX_ADJUST_26:	CHP .	AN, SPACE MEST CHAN	the same for both files.	1			
ADDIET IN	JE DEC JEP	MEST_CHAR DE SECOT HEXT_CHAR		C1_X07	280C	***	
		AL, SPACE HERT CHAR	; If symm char is space, ignore.	These two ex	breatin	es reed the erst 10% by: reached. The second bull appropriate pointers a	ee if end of buffer ;
			, as eyen come as space, ignore.	; reeched and	E44 605	reserver, the second by	re adjusted.
PORESTAL PARE	71	MEET CHAR					
PILES END:		HEST CHAR SHORT EVALUATE	Heed too metches for syst. If file 2 DOF, ekip to	i me onie			(COMPARE ASM continu

■ UTILITIES

C#_#C#11	EOR CHP CHP 28 28 200	SP, SP SI, FILE_ENG(SP) NOT ESP SI, SEPPES_ENG(SP) EGP SOOT NOVE SEPPES	:Pile index printer. :Is position = E000; :If no, not E00. :If no, not E00. :If no, B00. :If no, B00. :Is no E00. :If no, B00.		HOV HOV INT JC ADD HOV	SI, DE CS, TEN S AN, 3FN " 21M READ FILE END DE AE	phone it. phone it. phone file. plf failed, exat. ples, add bythe reed to boffer; address and above se file and
CK_BOP3:	200V	17,2	ito same for file 2.			FILE_END(NP), TO	chotes read in constant.
HAVE BUPTER:	29 CNP 29	NOT EDF DI, ROPER ENDING DOP	:Bare penaters.	WORDSTALL	MOV OCH CNP CNP 23	MEAD END ML, STYLE MASS AL, STYR MEAD END DS:[\$7], AL	phile if here bytes read. phise, retrieve strip mask. ; If net Worddtar, sklp. ; mise, strip the high hit ; of all bytes read.
	PURR	AN Me CS DS	, and represent	MAN SHIP MAN THAT THE	INC LOOP CLC	61 WORDSTAN	; of all bytes read.
	PUBB PUBB NOV NOV	HI HI, FILE HTART[DF] DI, DI , TEN S	Metgleve buffer start address.	HEAD FILE	Exce		
	REP	CE,TEN X / 2 MOVEW	;And move date to buffer ; 100 below.	: IMPUT			
	CALL 9/38 8/38 8/38 A00	MEAD FILE SAVE POS[SF], TES I STSC POS[SF], TES I FILE POS[SF], TES I SEX OPPOST[SF], TES S	:Reed the next 18%. :adjust sl1 the pointers by 18%.	OUTFUT Fore			
	ADD CALL	ANT APPROPRIATE LABOR	:Add 18% to offset. :If carry, add 1889h to segment.	tt preser			
DO_ARRAT:	CALL	CS. 4 (DE). TEN #	:Adjust line start array.	T2000_00719	790C	NIA.	:Transcree St.
BUS_ABBATT	MOV FIR INC INC LOOP POP POP POP POP POP	HI HI HI HI HI HI HI			MOV SET MOV	AE, 5000 100 AE, 460 BE, AE	:Preserve SS. :Nake sure active page is sero. :Point to the BOX MICOS date are
	POP POP	61 88 88			MOV COP	AL, DA: CPT_MODE AL, T	Betrieve current video mode.
		AT.			21 CHP 216	NCPPONTED AL. 1	Betrieve current video mode, Is it mone mode? If yee, continue. Is it tent?
	08 38 508 908 389	ADJUST PELET	rif file 1, edjust DI and AX.	UNICEPHONETED :	210	DE_DFFRET BAD MORE MIG ERROR_EXZT	III yes, continue. Illes, do not pass 60. On directly to jail.
ADJUST_PILET:	312 919 918	DE, TEN S SHORT BUT BUF BU, TEN E BE, TEN E	:Time, edjust B1 and BE.	SUPPORTED :	MIN MIN DET CHE JS	AK, 126 BL, 268 186 BL, 186	
MOT_BOF:	CLC RET					CH_COM BB-BTTE PTR (87a),0	:Is there as EDAY :If so, check if COA.
00P1 CK_90P	STC RET ENDP				TRUT 296 SOR BOY POUR 397 POP BOY	00,00 AL,1130s	plies, BMA info; In it notive? If ee, chick CGA. Slas, petrieve CRT rows.
INPUT IP - fale					397 909 800	20 20 30%, DL	; bare CRT rows.
OUTPOT.	s of lin	e-start array.		CK_CGA.	HOV HOV CHP 295 HOV CHP 295 HOV CHP	AL, EBYCHT_COLS AM, AM DE, AZ AE, LINE_CAPACITY	
ARRAY (BOOK	PROC	TEAN			283 807	MALETT CAPACITY DIL, WI AL, 48	pif me, stere. plie, one 18 as capacity. plee, we is 48 column mode? plf yes, cooless display.
-	MOV ENG.	81,8P 81,1	Multiply flie ledes by 4	CHACTE !		LINE CARACTET ER	off yea, essions display.
	SHL SHL ADD RET	SI, OFFEET LINE_ARRAY) to index leto index.	COR.	HOV HOV	EAVE COL(\$1,08	
AMAN_THOES	2002				MIN.	AE,1 DL,ROWD DL	pitore columna. pitoma two for attributs. pintrieve rows p and multiply. piewe as address of status line
SP = file	index to to As	CIS filesage.			HOP HOP HOP HOP SIC. HOV HIS. HOP HIS. HOP	STATUS LINE, AX DC., 4 DC., 1 WINDOW SINE, DL	; and multiply. ;Eave as address of status line ;Subtract 4 from CRT rows ; and divide by two ; and nave as window size.
CHTPUT CHTTY flag	::::	failed.			ADD ADD	AZ, 25:AZON_6545 AZ, 5 STATUS NEO, AZ AZ, 28AŠ	
BP preser					MOV ADG MOV CMP JB ADG MOV IMP MOV MOV MOV MOV	AX, 20AN VIDEO SED VIDEO SEG, 0000	pactions display card. Add als to get status register plore as status register. Pla it menochrome? Pla yes, does here. Plas, edjust video segment. Cost attribute at cursor postio.
09EF_PILE	PROC	NEAR			MOV INT	180	shed seen on foresteed.
	307 30 30 807	AX, 30669 218 OPER END	; Open file for reeding.			AF, 911791118 INVENSE ATTRIB, AN	pland manu no forground. Plip color bits. And manu no highlight stirlhot
OPEN END:	CALL DET	OPES END FILE_MANGE[SP],AK READ_FILE	:Form file handle if accessful ; and read 180.	1200 END:	POP NET	20	; Restore 16.
0029_PILO	Depr			VIDEO_SETTIF	ENDP		
I INFOT	Index	CIIS filenes.		1 MF07 2 AL - chec	actor to	write.	
				0079UT			
Corry fla		failed.		AL, AL	s press	red.	
ap preser		i		METTE_SCHARM	7900	NEAR	
MEAD_FILE	2900	TEAN	detailers fill-bandle		POSS MRV	DE, VIDEO_BEG DE, VIDEO_BEG	Print to adress separt.
	MOV	AN, PILE MANDES[MP] 00, FILE START[MP]	Point to storage buffer.				(COMPARE.ASM continu

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■ UTILITIES

9095_RET1	800V 800V	DELAL MALSE			NOV SUB	01,FILERAME(6F) bk,bi bk,2 sk,ok	Patriors secrets of filename; storage and save. Put in first byte of filename; boffer, the buffer lampth (80
	ACR CEI	MONS_RET	:Get states. 		MOV SUB MOV HOV HOV 1XT FURN HOV SCAND	AN, SAN 21H	reuffered Reyboard Impet. save filesame pointer. Corriege return points to last byte of impet.
exit:	DER JEC	AL.EX AL.1	its it highs if me, weit notil it is.	ARCITES	BOW SCAND JUE	AL. CR	
	MOV STOCK STI POP	25	Hetriame character; now it's DE to write to acress buffer. Interrupts back on.		SCAMB JHE HOW POP HOW CALL JHC HOW CALL	SYTE PTR (EI-1(.0 DI DE,DI DER,DI DER,DI PROMPT END	Replace it with more (AddIS), perijave filename pointer. patternt to upen the file. If sucreasivi, does here. perilage Perilage perilage perilage new prompt user again.
RITE_SCANES	2527				CALL JEP BET	DE OFFERT NOT FORMS AND FRIST STEING SECOT MEET FROMOT	s and prompt user again.
				PROMPT_DID:	RET		
Mane		į					
None All regiet				1 Marcy 2 MI = point 3 Matry point	s to st	ring to display.	
		waa		00721/7 5079		1	
SEPLAN_SETUP	PROC		scleen erreen	All regist	ers des	troyed.	
	HOV IPC	co, nove	Clear ecress. Satisface CRT rows. Howe case line below off screen- Column sero. Page sero.	WEITE IT: WRITE STRINGS	CALL	MRITE_SCHER	Write a character. Betriows a character. Beep writing until a carriaga return or apaca accountered.
	HOR HOW 1377	DC.DL SH.SH AB.2 186	:Bat curser position.		CHIP JAN RET	AL_SPACE WRITE_IT	; return or apaca accountered.
	EOR HOV CALL HOV EML	DI, DI BI, OFFERT COPTRIGHT BM, MCSMALL ATTRIB MBITE SYNTHE DI, COLE	Point to top isft of displey. Point to copyright message. ; and display it.	sios Rayboas	4 1/0		
	BOUL BOUL BOUL BOUL	DI, COLE DI, COLE DI, I DI, 64	;Betrieve nolumna.; toubis for attribute.; sight justify my name.; Dump pointer peat linefeed.	AEAO_RET:	HOV INT	AX, 6 168	Mait for next keyboard imput.
	EUS THC CALL HOV	ST MRITE_RTRIMS		a,m,	9097 1907	AN,1 168	;see if character reedy.
HERT_LINE:	907 POEE	CE, COLO	Initialize counter. Write line characters Bave position.	CLEAR IT: CLEAR FOT:	CALL	READ_ANY	jif characters are condy
687_WRITE:	CALL LOOP	MALLINE CHAR MRITE SCARES MEET PRITE) to erren.	CLEAN, NOT	CALL JUS RET	READ ANY CK MET CLEAR_IT	If characters are ready read them to class keyboard buffer.
	POP CHP ZA	NI NF, 2 SETUP_SMD	:Betrieve position. (Do two windows.	Serson class	ring coo	Lines.	
	PUSE PUSE ADD HOY CALL	OI OI, 18 AL, LF AAN CHAR MESTE SCREEN SI, FIERMANE (SP)	Tave acreen pointer. Tab in five spaces and print a laft ber cher.	CLS1	208	CH, CH	Top left serner.
	CALL	ST. PIERSONE (SP)	Point to filename and print it.		MOV MOV JHP	DE, COCH DE, DOME	:Bottom row. ;Clear the sermen.
	CALL HOY CALL	AL. ST BAS CHAS	Pinish frame with right bar chor	CLS MERSONS		SECRY CLEAR WINDOW CX, SIRES	owner to column sacra-
	POP	01 10	; Restore display pointer.		HOV DEC HOV THC CALL MOD THC	DR. COLE DR. WINDOW SIDE	skight corner.
	MOV INC	AN, I DL, WINDOW, SINK	multiply line leasth by window		18C		
	MUL ADD	0L 23 AX 27.2	rwaitiply lime length by window ; size plus one and add to ; current position to get to ; meat position to display lime.		ADO INC	CLEAR WINDOW CS,WIRDOW SIZE CS	clear the window. Therement a window size I and a delimiting line.
RTUP ERO:	JEP ANT	SP, 2 SHORT HENT_LINE	; meat position to display line.		100 100	CS DH, WINDOW, SIIS DS SHORT CLEAR WINDOW	Class second window.
HERAT SHTSP	DOF			CLE_MENU:	1977 208	CR. BOWS	portion row.
146.04					208 207 207	CL, CL DN, CH DL, 3CH	rTo relume 66.
COTPUT		- 1		CLEAR NINDOW	-		Francres SK. Wormal attribute. permit active page.
Hone				, , , , , ,	MOV MOV INT	SS, SCHMAL_ATTKIS AN, 4889 188 AN	
					POP	AN	;mentors 6x.
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				79197_STREEC	RET		
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	23 80V 80V	SYMTAN FLAG, 1 MEXT PROMOT STWIKE FLAG, 1 DE, OFFICE STWIKE MEG	:If first time through, display mystem message.	TEXT	2904 2904 200	PILET SPIPES + TOO	
MXT_FROMPT:	CALL	PRINT_STRIMS DE_PROMPT(SP) PRINT_STRING	metriava appropriate prompt				(COMPARE ASM en
-	CALL	PRINT_STRING	; and display.	A			R OMPARE ASM A



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Esc will return you to DOS, keeping the last mismatch on-screen to serve as a reference. COMPARE will work in any display format except graphics. It's worth noting that you can display almost twice as much information on the screen if you first change the video mode to 43-line EGA before running COMPARE

THE COMPARE ALGORITHM COM-PARE doesn't use any of the complicated block matching, recursive "longest matching sequence," "longest common sequence," or symbol-building tech-

niques associated with line-compare programs. These algorithms involve examining an entire file before reporting mismatches, so even transposition of large blocks can be detected. COMPARE's task is a little less ambitious and is limited to deteeting smaller individual differences within files. Thus, it can use a variation of the simple "scan until next matchine sequence" algorithm. COMPARE examines corresponding bytes of each file until a mismatch is found. Using the mismatched positions as anchors, COMPARE then tries to resynchronize the files by

looking up to 400 bytes ahead from each anchor position to find a match in the other

The casiest way to explain the algorithm is to follow the program's path step by step through the short example presented in Figure 3. COMPARE begins by comparing bytes starting with the first byte of each file. The comparison proceeds smoothly as long as corresponding hytes can be paired up. A mismatch occurs, however, at the "a" in "an" and the "n" in "not". This is saved as the anchor posi-

231, 653, 653, 772, 660, 773, 660, 7 以加加加,100万年60日,以中国10日,以中国10日,100万年61日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万41日,100万万41日,100万万41日,100万万51日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万41日,100万万万51日,100万万51日,100万万万51日,100万万51日,100万万万51日,100万万5 如源1245,1975年6月16日2日,中央中央部门公司经验的1986年8日,1987年6月18日,1987年6月18日,1987年6月18日,1987年6月18日 1987年6月18日 1987年6月18日 1987年7日 1987 6.《《中心》:从文书记录以前的文章的《四书的文章的》,即即建设和《诗》的《古代》:"我们的《文学》,即是"文学》,我们是"文学》,我们是"文学》,我们是"文学》,我们是"文学》,我们是"文学",我们 66年的25日的经济的经济中期的经过,在经济企业,但可以为了人们的经济,但是经济的现在,这种是20日,中国的人的人们的对于人们的人的人们的人的人们的人,我们也是这种的人,我们也是 66、16.200.3、201.5、16.6 (A. 10.20) (16

COMPARE.BAS: A BASIC program that will create COMPARE.COM automatically.

9-86 New Year Property of the 然《这种》为"我又到什么也是为他的现在分词,我也是为"不是的"的人不是的说法。他也与"我们的脑上"对她们是我的人。这就是我的女们是生了,就们们就越来了我们的一样,我也是

UTILITIES

COMPARE then attempts to get back in sync by checking to see if the 10-byte string "an original" (the space isn't counted) in FILE1 exists somewhere beyond the mismatching "n" in the "not" in FILE2. The search is done a byte at a time for two reasons that I'll explain further on. The "a" is first compared with "o" in "not" Since it does not match, COMPARE next tries matching the "a" with the "t" in "not". Again no luck. COMPARE continues the process and shortly finds that the "a" in "an" in FILEI matches the "a" in "original" in FILE2

This might be the signal that the two files are back in sync. To make sure, however, the program insists that the next 9 bytes must also match, so the "n" in "an" is compared with the "I" in "original." No good. So COMPARE returns to the point where it received its false alarm and starts again, comparing the "a" in "an with the "I" in "original". COMPARE thus continues to try to match up the "an original" string until it syncs up, or it reaches a maximum of 400 bytes from the anchor position of FILE2, or it reaches the end of file, whichever comes first. In this example, the end of file is reached with the compare of the "a" with the period of FILE2 without success in syncing up. (Actually, in a text file the period would usually be followed by a terminating Ctrl-Z. The results would be the same.)

The program doesn't give up at this point, however. It returns to the anchor positions of both files and increments to a new starting position in FILE1. This time it tries to match the string "n original t". The first bytes compared are "n" in "an" of FILE1 with the anchor "n" in "not" of FILE2. COMPARE gets excited again, though we already know it's all for naught, since the search will once again reach the end of FILE2 without syncing up. Proceeding in this manner, COM-

PARE inches along FILE1 until the "o" in "original" of FILE1 becomes the new starting position. This time, though starting again with the FILE2 anchor point (the "n" in "not"), it isn't many times through the compare loop before COMPARE succeeds in matching the 10-byte (sans space) "original th" string.

Once COMPARE is successfully syn-

tion to the start of the string match is displayed in inverse video. In this example, the "an" string of the first file and the "not the" string in the second are highlighted. The highlighted difference can be as little as a 1-byte insertion up to the 400-byte maximum reach of both files if no match is found. In the latter case, COMPARE dis-

plays the additional message, "Files sig-

nificantly different." Even then the program does not give up, however, and commences a new round of searching until the window is filled At this point you can choose either to

continue searching, by pressing any key except Esc, or to quit, by hitting Esc. It's still quite probable that a match can be found with additional searches if the differ-

```
COMPARE 1.8 (C) 1988 Ziff Communications Co.
                                                PC Magazine . Michael J. Mefford
    -SAMPLE1 -
This is a test file.
Notice that COMPARE is sot
confused by word wrap.
This line is the original sample
 e fast line is the same in both examples. .
SHIPLE2
This is a test file.
Motice that COMPARE is not confused by
This fiee is not the original sample.
The last line is the same is both examples. *
                                Compare completed
```

Figure 1: The COMPARE screen display defaults to text format. The differences are highlighted in reverse video.

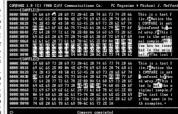


Figure 2: COMPARE can be forced to display in the hexadecimal format with the /B option. Note chronized, the text from the anchor posi- that the segment offset starts at absolute zero.

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ence in the files is not a lopsided insertion. deletion, or block move.

The reason a successive string is required before we are declared back in sync is to prevent false matches on embedded words such as the "the" in "thesis" Spaces are not counted in the string matches to avoid premature matches on indentations or tab positions that are delimited by actual spaces. (This is one of my two promised reasons why the compares are done a byte at a time, using the CMPSB instruction instead of the string compare instruction, REP CMPSB.) The large number of spaces between the instruction field and comments in the assembly listings provides an example of a situation in which spaces would otherwise confuse COM-PARE

As you can see, COMPARE's algorithm can comprise a considerable number of compares. This could test your patience with long working times on files that are significantly different. To minimize the working time, however, I made the SYN-CHRONIZE procedure in the assembly code as tight as possible, utilizing all the registers to hold values instead of going out to RAM.

WORD WRAP CONSIDERATIONS COMPARE makes special provisions for word-wrap paragraph reformation that results from insertions, deletions, or just plain changing the margins. Word processors deal with word wrap in ASCII files in one of two ways. The subtle difference between the two is whether a word-delimiting space is saved at the end of a line or is just inferred by the carriage return-linefeed combination. See sentences 1 and 2 of Figure 4. When displayed, these sentences look the same; the space at the end of a line is invisible since there is nothing to its right

FILE1 This is an original thesis. FILE2

This is not the original thesis. Figure 3: The article text explains how COMPARE proceeds when it discovers the

alien words "an" in FILE1 and "not the" in FILE2 in these two short file examples.

to make it show up. The actual files, however, will be differentiated by the space character. Since the sentences read the same, it is not desirable to bring attention to the space as a difference.

COMPARE applies a number of rules to avoid confusing word wrap with a mis-

 COMPARE makes special provisions for word-wrap paragraph reformation that results from insertions, deletions, or just plain changing the margins.

match. When 2 bytes mismatch, if one is a linefeed, the linefeed is skipped and the following byte is compared with the current byte in the other file. If one of the mismatched bytes is a carriage return, the corresponding byte is checked to see if it is a space character. If so, they are considered a pair and the next 2 bytes are compared. Otherwise, the carriage return is skipped (the same as with linefeeds) and the next byte is checked with the current position in the opposite file. (This is the second reason that compares are done a byte at a time.) As this may seem a bit complex, let's step through it, using the first two sentences in

Figure 4. The first mismatch will be the carriage return and the space character after the word "but". Following the above rule, these are considered a pair, so we go on to the next bytes in both sentences. Here we find a mismatch between the linefeed of the first sentence and the carriage return of the second. We ignore linefeeds, so we skip it and hold our position at the carriage return in the second sentence (it's not checked at this point). Next, we compare the "h" in "have" in the first sentence with the carriage return. This time since a carriage return is not mismatched with a space, the carriage return is skipped while

still holding the "h" position in the first sentence. We now are at the linefeed, which we ignore. That then brings us to the "h" in both sentences-a match, and we haven't missed a beat. The same algorithm also keeps things on track when sentences wrap at different words, as occurs in the third sentence in Figure 4. In fact, it will work with any combination of the three sentences in the example, though I'll leave

it up to you to work through it in detail. In a binary comparison the carriage return and linefeed are given no special treatment. COMPARE has no way of knowing if a 13 or 10 actually represents a carriage return or linefeed character. A 13 could be an OR AX immediate instruction (binary coded as character 13), a short jump or near call of 13 bytes, a part of a variable, or a carriage return. A linefeed could similarly be misconstrued. Therefore, unmatched carriage return-linefeeds are highlighted, as you see in the hexadecimal dump of Figure 2. This contrasts with their treatment in the text example in Figure 1.

MODIFYING COMPARE You may have wondered how I arrived at the requirement of 10 consecutive matching bytes to get back in sync. What I did was to use my PARSE program (Programming/Utilities, PC Magazine, January 27, 1987) to examine some of my documents and come up with an average number of characters per word. I then added a fudge factor for occasional big words and rounded it off to an even number-10. The 400byte value came entirely from my imagination. You may wish to change both the sequence (10) and the reach (400) values to suit your intuition. Decrease the reach if you find that COMPARE thinks too long; increase it if your files have major changes and COMPARE fails to sync up. Likewise, you can modify the sensitivity by increasing or decreasing the number of consecutive bytes required for a match.

To experiment with the synchronization algorithm, enter the following:

DEBUG COMPARE.COM E SED od ab

E 6F5 cd ab

E 6F9 ah ef

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COMPARE Command

Michael J. Mefford

1988 No. 11 (Utilities)

Purpose:

Displays the differences between two text or two binary files. Files need not be the same length, and paragraph reformatting changes introduced by word wrap are ignored.

Format: Remarks: COMPARE filespec filespec[/B][/W]

COMPARE's default assumption is that the filenames designated in filespec are to be compared as ASCII text files. Formatting commands embedded by word processing programs are reproduced on-screen but are not acted upon-Files in which the "high bit" is set (such as those produced by WordStar's document mode) can be made displayable in ASCII by entering the optional / W on the command line.

Files are displayed in two on-screen windows. Differences are shown in inverse video and are preceded by several lines of matching text to provide a context. When the windows are filled, pressing any key continues to search for differences; pressing Esc returns the user to DOS. All character modes, but no graphics modes, are supported.

Files with COM or .EXE extensions are automatically displayed in COMPARE's binary mode, which is similar to that produced by DEBUG.COM. Unlike DEBUG, however, COMPARE uses the IBM/ASCII symbol set rather than periods to show nonalphanumeric characters, and its segment offset begins a zero rather than at 100h. Any file on the compared in binary mode by adding the optional /B switch on the command line.

Note

When COMPARE finds a difference between files, it searches ahead up to 400 bytes (the reach value) for a string of ten (excluding spaces) successive matching characters (the sequence value). DEBUG.COM can be used to change the reach and search values on a copy of COMPARE.COM thus:

DEBUG COMPARE.COM

E 6ED cd ab E 6F5 cd ab

E 6F9 gh ef

o.

where abcd is the reach value in hex (default 0190h) and efgh is the sequence value (default 000Ah).

COMPARE BY MODEM

The programs published in PC
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nunications offware for either 3/00 er. 1,200 hts per count, 7 data bits, even parily, 1,500 hts per coue than 3/00 keal, even parily, 1,500 hts per coue than 3/00 keal, even parily, 1,500 hts, and full dipplex. You can use any of more than 3/00 keal, even point, 6/17,542 1/90 keal Yest, 4/21,200 keal, 6/17,542 1/90 keal, 6/

When you connect with PC Mag-Net, press Ctrl-C. At the USER ID prompt, enter 177000,5000. Enter PC*MAGNET at the PASSWORD prompt and enter Z10D8811 at the ENTER AGREEMENT NUMBER

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piled and ready to run. COMPARE BAS will automatically create COM-PARE.COM when run once in BA-SIC. COMPARE.ASM allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

LINK COMPARE; EXE2BIN COMPARE COMPARE.COM

MASH COMPARE:

Photocopy this page. Trim and holepunch the copy and add it to your DOS manual.

■ UTILITIES

where abcd is the number of bytes (in hex) that COMPARE will reach out to find a match before it gives up, and efeh is the number of bytes (excluding spaces) required for COMPARE to register a legitimate match. COMPARE defaults to abcd equal to 0190h (400 decimal) and efgh equal to 000Ah (10 decimal). Be sure to enter both bytes in each entry and make both of the reach parameters (abcd) the same to keep the synchronization search symmetrical.

BASE POINTER If you examine the assembly listing, you will notice that the BP (base pointer) is used extensively as an index register to each of the display windows, COMPARE's window variables are words and are stored in sequence. The base pointer is then given a value of 0 or 2 to access the appropriate variable. For example, the second window position can be retrieved with the two instructions

These sentences are effectively the same in context but<cr><lf> have word wrap to the next line in different places.

These sentences are effectively the same in context but <cr>cr><lf>> have word wrap to the next line in different places.

These sentences are effectively the same in context<cr><lf> but have word wrap to the next line in different places.

Flaure 4: The first two sentences are identical except for the additional space character at the end of the line. The third sentence is the same except that the line break is at a different word.

MOV BP, 2 HOV AX, WINDOW POS[BP]

The second instruction will compile to MOV AX.[BP+xxxx]

where xxxx equals the displacement of the first WINDOW_POS variable. By adding the BP's value of 2 to the displacement, we can easily address the second window's position. Normally the base pointer is used in conjunction with the stack segment to

access the stack instead of the data segment. Since we are dealing with .COM files here and the segments are all the same (as long as we don't change them), it is perfectly permissible to use the BP in this manner. There are just not enough orthogonal registers available in the Intel 80 series microprocessors otherwise. You have to inform the assembler that you wish the BP to be referenced as if the stack segment and data segment were the same. This is accomplished with an

Microsoft just generation gar

ASSUME SS: TEXT

directive. If you don't, the assembler will use its default assumptions and compile the above instruction as

AX.DS:[BP+xxxx]

The result is that an extra byte is added in the form of an unneeded segment override.

BUFFERED KEYBOARD INPUT One other routine deserves comment. COM-PARE uses the DOS Buffered Keyboard Input function call 0Ah to get filename information from the user if this was not supplied on the command line. All that has to be done to implement this call is to point DS:DX to a buffer with the first byte specifying the maximum number of characters the buffer can hold. On return, the second byte of the buffer will have the actual number of characters entered, followed by the input from the user. The character count

performance enhancement system.

excludes the terminating carriage return. which is always the last character.

This is a dandy little call that requires only a handful of instructions to achieve a line input editor complete with display output and cursor, courtesy of DOS and the BIOS. The editor control is not fancy: it doesn't utilize the familiar edit keys, Ins, Del, or any of the cursor-controlling arrow keys. The exception is the Left Arrow. which acts like the Backspace key, erasing the character left. You can live without those editing features, however, in a simple input prompt, and you'd probably see function 0Ah used by many programs but for one annoving quirk: its implementation

of the Esc keypress.

Esc should always act as a rip cord, taking you back to where you were or canceling the current operation. Pressing Esc from function 0Ah, however, spits out a confusing backslash path-delimiter character and sends you to the next line. Esc

will clear the buffer, thus canceling any incorrect entry, but the chances are that the user's intention in hitting Esc was simply to quit COMPARE. Instead, he finds himself locked in until he hits Enter after typing in a correct filename. The only way to quit buffer input (and thus COMPARE) at this particular point is to use Ctrl-C or Ctrl-Break. The trade-off in code space saved by using this call is well worth it in a short utility like COMPARE, for the need to guit the program in the middle of entering the filenames is rare. COMPARE won't get used quite as of-

ten as DR, but when the need arises, it's wonderful to know that you can review and approve the editing changes in a manuscript so fast that you won't even have to delay your dinner. Enjoy the leisure it creates.

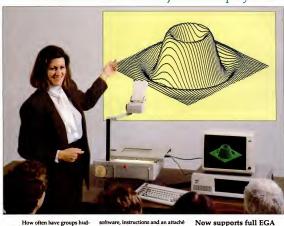
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IBM'S OS/2 PROGRAMMING TOOLS



IBM's OS/2 technical documentation is poor, its Programmer's Toolkit is full of dull chisels, and its C/2 compiler and Macro Assembler/2 are outmoded versions. So what else is new?

as there ever been an operating system that provided adequate technical documentation? Perhaps not, but that's hardly an excuse for the overpriced and deficient documentation that IBM is now selling for OS/2 1.0.

what is now sening for OSy2 Lo.
What's most disturbing is that IBM's documentation is largely derived directly from the earlier documentation distributed by Microsoft. It may be the best we can hope for. That's discouraging. Regardless of the merits of OSy2, its success depends in part on the availability of good documentation and reasonably priced programming tools. What I see from IBM is not it. The story thus far:

When Microsoft brought out its mammoth \$3,000 OS/2 Software Development kit in April 1987, company spokesmen said informally that the high cost was due to its unique nature as a prerelease version of the product. Lower-cost OS/2 software development kits, they said, would be

available early in 1988.

Well, it is early in 1988 (mid-February) as I write these words, and Microsoft's lower-cost OS'2 software development kit is still an unannounced product. IBM beat Microsoft to market with its own OS/2 programming packages. These first appeared on the shelves of software stores at the same time as OS/2 itself, late in De-

cember 1987.

Are Microsoft and IBM partners or competitors? It's hard to tell sometimes. OS/2 was developed under the IBM/Microsoft Joint Development Agreement, and both IBM and Microsoft sell versions of OS/2. IBM sells OS/2 on a retail level to

owners of PC ATs and PS/2s. Microsoft sells OS/2 to hardware manufacturers who configure it for their own AT compatibles. But both IBM and Microsoft will be selling retail versions of OS/2 software development kits.

That's OK, of course, as long as the IBM and Microsoft packages are basically the same. Guess again. Did you think they'd make it easy for you?

PACKAGING Overall, the OS/2 software development kits available from IBM and Microsoft will be similar and have a lot of overlap. But they will be packaged very differently.

IBM has two packages out now: the OS/2 Technical Reference (\$200) and the OS/2 Programmer's Toolkit (\$750). Each of these packages has an update card. Mail it in and IBM will send you free updates for OS/2 1.1 (which includes the Presentation Manager).

■ The OS/2 software development kits from IBM and Microsoft will be similar and overlap. But they will be packaged very differently. Microsoft, on the other hand, will be selling separate software development kits for OS/2 versions 1.0 and 1.1. Neither has been announced at the time I'm writing this column, but I understand the OS/21.0 kit will cost about \$350. They say it will have a few more utilities than the two IBM nackaeses combined.

In one sense this is a "pay now or pay later" situation. You can get a complete OS/2 1.0 software development kit from Microsoft and pay later for an OS/2 1.1 kt, or you can pay more money for the two IBM packages but get free OS/2 1.1 up-

I'll discuss IBM's releases here and Microsoft's in a later column—when I get my hands on them.

IBM'S TECHNICAL REFERENCE The IBM OS/2 Technical Reference (\$200) totals about 1,200 pages of documentation and is divided into two binders.

Volume 1 presents an overview of many of the OS/2 functions, by category, and contains information on device drivers. Programmers writing OS/2 utilities and applications will leave Volume 1 on the shelf most of the time.

The bulk of Volume 2 consists of documentation of the 221 OS/2 1.0 function calls, presented in alphabetical order. Volume 2 also contains the IOCTL ("I/O control") subfunctions for making calls to device drivers.

The documentation of the OS/2 function calls is nearly identical to that in Microsoft's \$3,000 OS/2 Software Development Kit. There were problems with

■ ENVIRONMENTS

Microsoft's earlier documentation, and most of these problems still exist in IBM's

One such problem involves the return codes of the OS/2 functions. Most OS/2. 1.0 function calls return a zero if all goes well and a non-zero error code otherwise. The Technical Reference manual indicates this with pseudo-code:

IF AX = 0 then NO error ELSE AX = error code

These two lines are repeated for virtually every function. All the possible error codes (over 300 of them) are listed in Appendix A of the manual.

What you don't get is a list of possible errors that could be returned from each function. In some cases, this is essential information. As any programmer knows, one of the most difficult aspects of programming is dealing with errors. The IBM Technical Reference tells you what each function is supposed to do, but it does not tell you what can go wrong.

IBM recommends that programmers use the DosErrClass function when a program encounters an error from an OS-2 function. The DosErrClass function is similar to the interrupt 21h function call 59h ("Get Exended Error") provided in 100S 3.0 and above. This function call divides errors into classes and recommends actions the program should take to deal with an error. But this is not always adequate.

EXPECTED *ERRORS* For example, some OS/2 functions return non-zero values to indicate the expected outcome of a function call rather than a real error. One of these functions is DosSemWait, which waits until a semaphore is cleared:

DosSemWait (SemHandle, TimeOut)

The second parameter of the function is a "time-out" value, in milliseconds. Normally, DosSemWait will not retum until the semaphore is cleared. However, if the time-out period clapses without the semaphore being cleared, then DosSemWait will retum anyway.

You might expect IBM's Technical Reference to indicate the return value of DosSemWait for these two occurrences. But it does not. Only through experimentation—and some line-by-line searching through the list of error codes—an you determine that DossEnWait returns a zero if the semaphore is cleared and a value of 121 (named the ERROR_SEM_TIME-OUT error) if the time-out period elapses. Of course, in a program you must differentiate between the ERROR_SEM_TIME-OUT return value and other possible DosSEnWait errors, such as number 187 (ERROR_SEM_NOT_FOUND).

VioPopUp is another function that can return non-zero values even in the absence of real errors. For example, one flag used with VioPopUp indicates that you want the function to perform in "transparent

■ The IBM Technical
Reference tells you what
each function is supposed
to do, but it does not tell
you what can go wrong.

mode." In transparent mode, OS/2 will not clear the screen when VioPopUp is called. But if the video mode is currently an EGA graphics mode, VioPopUp will return a non-zero value when you request transparent mode. A program would probably react to this by calling VioPopUp again without requesting transparent mode.

IBM's manual says that if you call Vicpelly with transparent mode and OS/2 cannot comply, "a unique error code is returned in this case." What error code is that"you ask. On the last of 16 pages of error codes, you'll find one that looks as if it fits the bill—the number is 483 and it's called ERROR_VIO_TRANSPARENT POPUP. But wouldn't it make more sense to indicate this in the documentation for VioPopUp?

Another example: When you allocate a block of memory, you can optionally specify that the memory is "discardable." If OS/2 runs short of memory it can free discardable memory blocks. When a program wishes to access one of its discardable memory blocks, it must first call the Dos-LockSeg function and temporarily prevent

that memory block from being discarded. Here's what the manual says about Dod.cockSeg: "If a segment is discarded while unlocked, a subsequent Dod.cock-Seg request for that segment will return an error code indicating the segment on proceedings of the control of the control

PROGRAMMER'S TOOLKIT In addition to the Technical Reference, IBM sells an OS/2 Programmer's Toolkit, for \$750. This package contains a 200-page Programmer's Guide manual, a high-density 3½-inch diskette, and a high-density 3½-inch diskette. The two diskettes contain the same files.

The Programmer's Guide is an extended discussion about OSi 2 programming in C and assembler, with sample programs. There is some good information here, including some that you won't find elsewhere (for example, a recommendation that OSi-2.10 programs should have a 2K stack). The diskettes contain several utilities sometimes used in OSi-2 program de-

velopment:

BIND.EXE and API.LIB are necessary for writing dual-mode (or Family API) programs that run under both OS/2 and DOS. You do not need these to write programs that run only under OS/2.

IMPLIB.EXE is helpful (but not necessary) for writing dynamic link libraries. It creates an import library from a module

definition file.

MKMSGF.EXE and MSGBIND.EXE make message files. You should consider using this message facility if you are writing programs that will be adapted to foreign-laneager markets. Otherwise, put

message text in your programs as normal. The diskerte also contains 11. C files and 20 ASM files that demonstrate various aspects of OS/2 programming. These programs are described in the *Programmer's Guide*, but you need an OS/2 C compiler or macro assembler to compile or assemble them. Also included are some "include" files. ■ DOSCALLS.H and SUBCALLS.H are C header files that you'll need to call OS/2 functions from C programs.

■ DOSCALLS.INC and SUBCALLS. INC are assembly language macro files used for calling OS/2 functions from assembly language programs.

INCONSISTENT HEADER FILES.
The Cheader files in IBM's Programmer's Toolkit indicate another problem with IBM's OS'2 Technical Reference. Several OS'2 functions require the program to pass a pointer to a structure. The anames of the OS'2 structures documented in the Technical Reference are usually not the same as the structure names defined in the C header files in the Programmer's Toolking.

One example: the documentation for the KbdCharth function indicates that it takes a pointer to a structure named Char-Data: In the SUBCALLS. H header flowever, the structure is named KeyData. The structure fields are described in the Technical Reference manual, but none of the fields are identified by the names used in the Cheader files.

This means that if you're programming for OS2 in C you'l have to pint out a copy of the DOSCALLS. H and SUB-CALLS. H header files to supplement the Technical Reference documentation. This is a pure goof on IBM's part. There is no meason why the Technical Reference documentation can't use the same structure names as the Cheader files.

TRASHY MACRO FILES The Programmer's Toolkit also includes macro files for assembly language programming. But I will not be using these macro files in the OS/2 assembly language programs I present in this column, because they're virtually worthless.

The first problem is that the macro files have no definitions of the OS/2 structures. As you'll recall, the source code for WAKELP/ASM shown in the April 26 couple of structure definitions that are needed for obtaining the date and time and for calling the KbdChartn function. It would have been tine; for IBM to give the world a standard macro file containing OS/2 structure definitions. But are OS/2 structure definitions.

Instead, these files contain macros that

■ There is no reason why the *Technical Reference* documentation can't use the same structure names

as the C header files. This

is a pure goof by IBM.

"ease" the calling of OS/2 functions. But these macros are not very flexible, and in some instances—particularly where a double word has to be pushed on the stack—the macros generate a great deal of unnecessary code.

Let's look at an example. The Dos-NewSize function changes the size of an open file. The parameters are the file handle (a 16-bit word) and the desired file size (a 32-bit double word).

If you want to call DosNewSize from an assembly language program without using the macro files, you need to indicate that the function is external and located in another code segment, thus:

EXTRN DosNewSize:FAR In your data segment you'll define two variables like this:

FileHandle dw ? NewSize dd ? After you set these two variables, you can

After you set these two variables, you ca call DosNewSize: Push [FileHandle]

Push Word Ptr [NewSize + 2] Push Word Ptr [NewSize] Call DosNewSize

That's typically how we've been using OS/2 functions in the programs shown in this column.

If instead you want to use IBM's macro

If instead you want to use IBM's macro files, you include the file in your program like this:

INCLUDE DOSCALLS.INC
You don't have to declare the DosNew-Size function with the EXTRN statement. You have two variables as before:

FileHandle dw ?
NewSize dd ?
and you simply call the function like this:

@DosNewSize FileHandle, NewSize
That certainly seems nice and convenient. The bad news comes when you look

at the code generated by the (a DosNew-Size macro. Brace yourself. Here it is: Mov AX, FileHandle Push AX, Push DS

Push AX
Push BX
MOV AX, Seg NewSize
MOV DS, AX
MOV BX, Offset NewSize
Push Mord Ptr [BX]
MOV AX, [BX + 2]
Push BP
Proh BP
Proh BP
AX
Chg [BP + 6], AX

Xchg [BP + 6], XX
POP BP
MOV DS, AX
POP AX
POP BX
Push AX
call DosNewSize
This is not a joke. If you work out this
code, wou'll find that it does the same thing

as the shorter code shown above.

That's disturbing. What's the point of programming in assembly language if you use a macro that generates 15 lines of unnecessary code? You get more efficient code when calling DoN-kw-Size from a C

program!
Let's continue with this example. Suppose the new file size is the result of a calculation in your program. At the end of this calculation, the value is stored in registers—the high word in DX and the low word in AX. You can call DosNewSize like this:

Push [FileHandle] Push DX Push AX Call DosNewSize

Using the macros, you would . . . well, you can't use the macros with DX and AX directly. You'd have to store the registers in memory first.

It gets worse. Some OS/2 function calls have a dou-



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ENVIRONMENTS

ble-word parameter that is documented as "reserved." Under the current version of OS/2 you push two zeros on the stack. DosChDir is one such function. If you want to use DosChDir to change to the root directory, you need a character string that defines the directory:

NewDir 11. 8

Assuming that DS references the segment containing NewDir, you can change to the root directory using the code

Push DS Push Offset NewDir Push 8 Push @ Call DosChDir

(The use of the 80286 Push Immediate instruction implies that the code will run only under OS/2 and not be used in a dual-

mode program.) If you want to use the macros, you must also define a variable for the reserved double word that looks like this:

Reserved dd

You make the call to DosChDir thus: @DosChDir NewDir, Reserved

Here's the generated code:

Mov AX, Seq Newdir Puch Av Lea AX. NewDir Push AX Push ps Push BX Mov AX, Seg Reserved Hov DS, AX MOIT BX, Offset Reserved Push Word Ptr [BX] Mov AX. [BX + 2] Push BP Push SP Pop RP Xchg [BP + 6], AX

POD RD DS. AX AX

BX Push AX

Call DosChDir

Gimme a break!

Sometime in the future, if you're disassembling someone else's OS/2 program and you see some crazy code that looks like these examples, you'll know that

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■ ENVIRONMENTS

some poor schmuck decided to use IBM's macro files. As I said, I won't be using them in any OS/2 assembly language programs I show in this column. Instead, we'll get a lot of exercise by doing all the PUSHing ourselves.

CAND MASM IBM also has an OS/2 C compiler (C2) for \$525, and a macro assembler (Macro Assembler/2) for \$225. These are originally from Microsoft. They are dual-mode applications that run under both DOS and OS/2, and they come with all the expected utilities (MAKE, LIB, CREF, EXEM/DD, LINK) as well as Microsoft's Code/lew debugger.

Although IBM's C and MASM come from Microsoft, they are not the most recent Microsoft versions. The C compiler and macro assembler packages that Microsoft now sells for DOS are labeled Version
5.0. IBM's C/2 compiler is basically a protected-mode version of Microsoft's C 4.0.

■ The new Microsoft

CodeView can handle

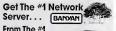
multiple threads; the one
sold by IBM cannot.

and IBM's Macro Assembler/2 is a protected-mode version of Microsoft's Macro Assembler 4.0.

That's a problem. IBM's C/2 includes neither the new C 5.0 optimizations nor the revisions that Microsoft made in C 5.0 for compatibility with the emerging ANSI C standard. OuickC is not included. Likewise, Macro Assembler/2 does not support the simplified segment directives in Microsoft's Macro Assembler 5.0. Although IBM's C/2 and Macro Assembler? both come with a version of Microsoft's CodeView debugger, it is not the same version that Microsoft recently distributed as an update to its \$3,000 OS/2. Software Development Kit. The new Microsoft CodeView can handle multiple threads: the one sold by IBM cannot.

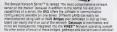
MISSING HEADER FILES As we've seen in previous columns, the structure of the OS/2 application program interface (API) greatly eases the calling of OS/2 functions directly from a high-level language. The OS/2 functions use the same protocol as functions within the language itself.

In a C program, however, you must first declare any OS/2 function you call by using a function prototype or template. The function declaration tells the C compiler that the OS/2 function requires far (or intersegment) calls using the Pascal calling



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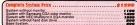


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More Capabilities Than Rivals

RPT FROM PC WEEK REVIEW MARCHIS, 1988, USED WITH PERM

by Marvin Bryan

The king of the crowded forest of Lotus 1-2-3 database add-ins is unquestionably @ BASE...

@ BASE was developed by Personacs Corp. of Concord, Mass. makers of the popular SeeMORE utili-ties that add additional columns to the screen displays of Lotus 1-2-5 and

With 6g BASE, it's possible to build colornal 32 M-byte databases in the standard dBASE III Plus format without ever using dBASE itself. Users can convert a normal 1-2-3 database instantly into a dBASE-compatible file, as well as set up dynamic links that will import updated information from dBASE records every time a workshort is mealculated. A database can be sorted alpha-

ically, numerically or chronologically on as many as 128 levels In fact, (ii) BASE will pack and sort records as much as three times faster than dBASE... Data can be analyzed with a

es-tabulation module to provide lightning-fast reports in resconse to such questions as: "What sales people in each division earned more than \$20,000 in commissions this month In addition, records can be and or examined in a form view

where each record occupies an indi-vidual screen. Alternatively, of course the user can choose the usual one record to a line format We tested the current \$195 rele We tested the current \$199 remease of @ BASE along with a beta copy of the Option Par, which will retail for \$89 55. Together, these two relatively inexpensive products provide truly remarkable

In addition to the indexing feature, the Option Pac will join files to make relational databases, create computed or derived fields, sort a

database without rearranging the keep files in the correct sorting ord

during record entry or updating. See our ad on page 17 @BASE

A database add-in for Lotus 1-2-3 that will access and create dBASE files without the use of dBASE itself A superior product in every resp

Price: \$195 From: Person Personics Corp. 2352 Main St., Building 2 Concord, MA 01742 (817) 897-1575 (800) 445-3311 X1101

As a borner, dBASE data can be turned into 1-2-3 graphs with practically no effort at all...

Personics has developed a series of @ DB functions to personn calculations and evaluate records within @BASE....Each of these functions us one or more arguments to identify the database, record or field to be acted upon. Some functions allow criteria to be established, such as selections a

subset of records. The 200-page marrial for @ BASE is excellent. The program acids less than 80K bytes to the RAM overhead of 1-2-3. For those who use both dRASE and Lotus 1-2-3, @ BASE is practically

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ENVIRONMENTS

sequence. It also tells the compiler the data types of the function arguments.

PRODUCTIVITY

The 221 OS/2 1.0 functions and the structures they use are declared in two C header files named DOSCALLS.H and SUBCALLS.H. But IBM's C/2 package does not contain these two files. They are only in the \$750 Programmer's Toolkit.

What this means is simple: You can write C programs for OS/2 using IBM's \$525 C/2 compiler with all the normal C library functions. But if you want to call an OS/2 function directly from your C program, you must also obtain the OS/2 Technical Reference (\$200) for documentation

 If you want to program for OS/2, you have to pay through the nose for the privilege.

on the function. If you're sharp and know what you're doing, you can write your own OS/2 function and structure declarations and put them in your C program. But it's much safer and easier to use the DOS-CALLS.H and SUBCALLS.H header files, and for these you must also obtain the Programmer's Toolkit.

That means you'll be spending a total of \$1,475 for three IBM packages to program in C for OS/2. Throw in another \$225 for the Macro Assembler/2 and you're up to \$1,700. That's far too much money.

THE HIGH COST OF COMPUTING Before DOS, we had CP/M, CP/M came with an 8080 assembler and a line editor. With DOS, we also got a free line editor (EDLIN) and a BASIC interpreter, but the assembler cost extra. With OS/2, nothing is free. Neither EDLIN nor the BASIC interpreter runs in protected mode. If you want to program for OS/2, you have to pay through the nose for the privilege.

This is an insult to programmers and is clearly detrimental to the future of OS/2. If I didn't know better, I'd swear that IBM and Microsoft were trying to sabotage OS/2 by inhibiting the development of ap-

■ ENVIRONMENTS

plications and utilities. Where will the OS/2 programmers of tomorrow come from if it costs \$1,700 to get started?

IMPLICATIONS FOR US Under the assumption that \$1,700 is still a lot of money for most readers of this column (it's certainly a lot of money to me), I'll try to write the OS/2 utilities I present here so that you can re-create the .EXE files as inexpensively as possible. This means that I will be sticking to assembly language for the time being. Programming for OS/2 in C seems

to be simply too expensive. Because IBM's Macro Assembler/2 does not support the simplified segment directives introduced in Microsoft's MASM 5.0, I will not use them in the OS/2 programs shown in this column. This means that you'll be able to assemble the programs using Microsoft's MASM 4.0 or Microsoft's MASM 5.0 under DOS or OS/2's DOS compatibility mode, or using IBM's Macro Assembler/2 under DOS or OS/2. You'll also need LINK.EXE and DOSCALLS.LIB, which are included with the OS/2 retail release, but nothing else. You will not need IBM's Programmer's Toolkit.

Obviously, there's no way I can document all 221 OS/2 1.0 function calls in this column, so the purchase of a Technical Reference may be helpful. But there are alternatives to that. They're called books, and in a forthcoming column I'll discuss the various books now available (six at last count) that are devoted to OS/2.

Meanwhile, I'm still waiting for Microsoft's "lower-cost" OS/2 software development kit. I still have a few hopes that it will be in better shape than IBM's, but it doesn't look now as if you'll escape with a significantly less depleted wallet. Once a company charges \$3,000 for a software development kit, it loses all sense of per-

What we need now is clear. We need a company skilled in creating low-cost programming software to tackle the job of putting together a low-cost OS/2 software development kit. Perhaps everything-compiler, header files, import libraries, debugger, documentation-can be sold in one simple package.

Wouldn't that be nice? Are you listening, Borland?

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CONVERTING **ASCILTIME** AND DATE STRINGS



To add to your growing library of programming routines, here are two MASM routines that let you switch ASCII time or date strings into their binary equivalents.

The previous two installments of this column have presented C and MASM routines that convert binary times and dates into ASCII strings for display. This time, in the interest of completeness, I'll supply conversion routines that go in the other direction, converting an ASCII time or date string into its binary equivalent.

THE SCANTD ROUTINES The file SCANTD ASM, shown in Figure 1, contains the source code for two public rou-

tines, SCANDATE and SCANTIME. Not 1 surprisingly, SCANDATE converts an ASCII string of the form into a binary date, while SCANTIME con-

verts an ASCII string of the form

mm/dd/vv

hh:mm:ss

into a binary time (the seconds field is op-

tional) Both routines perform a moderate amount of validation on the strings they

process, making sure that all necessary fields are present and separated by appropriate delimiters, and that each field (month, day, etc.) has reasonable values. They use the Carry flag as a general indicator of success or failure: if the Carry flag is set on return, the date or time could not be converted; if the Carry flag is clear on return, the date or time string was valid and converted successfully.

SCANDATE and SCANTIME return their results in the same 4-byte format used by the MS-DOS Get Date and Get Time

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Call with: Desd: address of string	1						; mdy, dmy, or ymd
; call with: Desir = address of string down 1; south dw n1; year day dw o1; day	- 6	SCANDATE	coovert ASCII date to bioary				
; Returns: Cerry = Set if bad date dwy dw oi ; day	i		,	ndy	dw		: day
; Returns: Cerry = Set if bad date ; or day dw oi ; day	i	call with:	DG:SI = address of string		dw		: mooth
; Returns: Carry = Set if bad date ; or dmy dw of ; dmy	1			100	d₩	n3	
day dv o1 ; day	4	Between	Carry - Set if had date				
	•			day	du	01	. dev
(continues)							
	,		carry - crear in quote tace	3.0			(cominers)

■ POWER PROGRAMMING

	dw	n2 n3	- 1	month		pop	ex.		return to celler
								,	return to celler
ymd	dw	n3 n2	1	dey	scantim	e endp			
	dw	n1	;	year					
detvel	dw	31,28,31		days in month	scandat	e proc	near ;	conv	ert ASCII date to binar
,	dv					push	4X	;	seve registers
	dv	31,31,30				push	box		
cbuff	dh	34 dup (#)				push	00		
		34 dup (#)	,	current country info		cell	qutctry		get internationalizatio
DATA	ends							;	info if first call
TEXT	segment	word public 'c	ODE.			cell jc	cbknun acend9	;	convert first field jump, bed number save result
	assume	ce: TEXT, de:DG	ROUP			nov	n1,ex	;	seve result
	extrn	atoimeer		we need ATOI routine		cell	el,[si-1] cbkdlm	- 1	get delimiter and check it
	public	scantime	,	make these routines	1	je	scend9	1	exit, bad delimiter
	public	scendete	,	aveilable to Linker		cell	chiroum		convert second field
scantime		neer ; (ert ASCII time to binery		1c	ecand9	,	jump, bad number
ecent 1me	-				1	BOY	n2,ax	3	save result
	push	ax bx	;	save registers		mov	ol.[si-1]	1	get delimiter
	push	di				ic	chkdlm scand9	1	end check it exit, bad delimiter
	pusb					cell	chknon		convert third field
	cell	getctry	- 1	get internetionelisation		Se	ecand9	1	jump, bed number
			1	info if first cell		MOA	n3,ax	1	end seve result
	cell	cbknun scant?	3	convert first field				1	validate entry and
	je mov	n1, ax	;	jump, bad number seve result				1	loed results
	mov	al,[si-1]		check time delimiter		NOV	bx,dfptr	,	point to year
	cell	cbktlm				CED	bx,[bx+4] word ptr [bx], ecand9		year must be 68-99
	je	scant9	2	jump if no good		jc	ecand9	!	jump, bad year
	call	cbknum	,	convert escond field		CNC	word ptr [DX],	100	
	jc	scant9 n2.ax	1	jump, bad oumber seve result		jc	scand9		jump, bad year load year and correct to renge 1968-1999
						add	cx,[bx] cx,1900	- ;	to renge 1988-1999
	mov	n3,0	1	force seconds = 0					ediust days/month table
	mov call	el,[si-1] chktlm	3	another field present?		MOA	daytab+2,28		
	ic call	ecanti	1	if no delimiter,		test	word ptr [bx],	3 1	is it a leap year? jump, not multiple of 4 fix table for leap year
	cell	chknun		convert third field		NOA	daytab+2,29	;	fix table for leap year
	je	scant9		tump, bad number	scandt:	BOY	bx,dfptr		point to month
scant1:	BOA	n3,ax	1	save value validate entry		BOY	bx,[bx+2]		
						jc	scend9	. ;	month must be 1-12 jump, bad month
	cmp 1c	word ptr n1,0	!	houra must be 0-23 jump, bad hour		cap	word ptr [bx],	13	month must be 1-12 jump, bad month
	cmp	word ptr n1,24	,	Jendy new mount		ic	acend9	1	jump, bed month load month result
	cnc jo	scants		tump, bad hour		BOY	dh,byte ptr [b di,[bx]	ox 11	load month result
				,		dec		1	elso prepere to index into deys/month table
	cmp 1c	word ptr n2,0 scant9	1	minutes must be #-59 jump, bad minute	1	shl	di,1		
	cab	word ptr n2,60		,,,		BOY	bx,dfptr	1	point to dey
	je	scent9	1	jump, bed minute		enp jc	bx,[bx] word ptr [bx], scend9	1 ;	day must be >= 1 jump, bad day
	стр	word ptr n3,0	;	seconds must ba #-59		no.	ax,[di+daytab]	1 1	get max dey for this month from table
	je cmp	word ptr n3,60	3	jump, bad second		свр	ax,(bx)	3	month from table
	CMC					je	scend9	1	jump, bad day load day result
	je	scant9	,	jump, bed second		BOA	dl, byte ptr (b	1 [X	loed day result
				loed the results	scend9:			1	common exit point
	BOY	ch, byte ptr n1 cl, byte ptr n2	- 1	hours minutes		pop	es di	3	restore registers
	BOY	dh.byte ptr n3		seconds		pop	bx		
	nov	d1,0		hundredths elweys - 0		pop	ax	,	return to celler
cent9:			1	common exit point				-	
	pop	es di	,	restore registers	scendat	endp			
	pop	bx							(Figure Leonton)

services (interrupt 21h functions 2Ah and 2Ch, respectively). Thus, they can be conveniently used with the devt and text

routines presented in the last column. The table "SCANDATE and SCAN-TIME Calling Sequence" summarizes the arguments and results for the two procedures. I should mention that SCANDATE and SCANTDATE are classic examples of the essential—but hair-splitting and timesome—MASM application-building tools one—MASM application building tools one—MASM application building tools one—MASM application building tools one may be applicated to be applicated by the property, and then put them in an object module library and forget about the details forever.

HOW SCANTD ROUTINES WORK The SCANDATE and SCANTIME routines build upon a number of auxiliary routines that are not exported for use by other

modules.

The first such helper routine is

getetry, which checks the MS-DOS version and calls the Get Current County Information service (interrupt 21h function 38h) if the bost operating system is Version 2.0 or later. It uses the date format code returned by that function to set up a pointer that assists SCANDATE in interpreting ASCII date strings. Code 0 is the "mdy" format used in the United States,

European countries, and code 2 is the "ymd" format preferred in Japan. Two other very simple subroutines, chktlm and chkdlm, test whether a character belongs to the valid set of time and date delimiters. The actual delimiters are stored in tables named tlmtab and dlmtab. You can alter or expand these.

code 1 is the "dmy" format used in many

tables freely to suit your own purposes, and the chktlm and chkdlm routines will adjust their actions accordingly.

The procedure chknum is called by SCANDATE and SCANTIME to convert

an ASCII numeric string to binary. The routine ATOI (from our February 16, 1988, issue), which is called to othe actual work of conversion, simply terminates on any nonnumeric character and does not return error codes. Thus, we must wrap the call to ATOI inside the procedule herous binknum, which tests for the existence of

at least one numeric digit.

Assuming that these various helper routines are in place and functioning properly.

SCANDATE and SCANTIME operate in
a rather similar and straightforward maner. They first covered all of the ASCII numeric fields in the supplied string to binary
by calling of khoun _ of khtln_ and
chkdln_ and they terminate with an error
ling if a required field is missing or an invalid delimiter is encountered. The results
are stored in the variables NI, NZ, and NS.

At this point the two procedures diverge somewhat; since SCANTIME is simpler, it will be discussed first. Each of the con-

cbkdlm	proc	neer	; check dete delimiter				; DS:DI = ASCII field : returns:
			; AL = cheracter to check				; Cerry - cleer if OK
			; returna:				; AX - velue of field
			; cerry = Clear if OK) OE
			; Carry = Set if not OK				; Cerry = set if not OK
	push	da	; make delimiter table				; check if >= '8'
	pop	0.8	; addresaeble		cmp	byte ptr [ai], '@	•
	mov	di,offset DGRO cx,dlmtab leo	UP: dlntab	1	jb	ohkn1	; jump, bed digit
	repne		; compere to table				; check if <= '9'
					cmp	byte ptr [si],'9	**1
	je	ebkd9	; jump if match found		cac		; invert Cerry fleg
			; (Carry is cleared)	2	je	ebkn1	j jump, bad digit
	atc		; else force cerry = ast	1	call		; convert field end
					clc		; clear cerry flag
chkd9:	ret		: back to celler	3			
:bkdlm				chkn1:	ret		; beck to celler
HEGIN	enup			obknum	endp		
rbktlm	proc	Dear	; check time delimiter				
			r call with:	getctry	proc	neer	get country information
			: AL = oberecter to check		test	dfptr1	did we already get info?
			: returns:		inz	geto2	; if we did, just exit
			: Carry - Clear if ok	1	,		,, ,
			: Cerry - Set if not OK		mov.	ex.3090h	: Fxn. 39b = get DOS vers.
			,, 11 1100 011		int		transfer to MS-DOS
	pusb	de	: make delimiter table				,
	bob	84	1 addresaable		or	el.el	; is it version 1.x?
	boh	di.offaet DGRO			12		: yea, jump
	BOY	cx, timtab len	or .cancab	1			
					mov	ax, 3899h	; get current country info
	repor	aceab	; compare to table		MOV	dx, offset DGROUP	rebuff
					int	21h	; trenafer to MS-DOS
	Se	chkt9	1 jump if match found				
			(Cerry is cleared)	getc1:			g get date code (defeult=0)
					MOV	bx.word ptr cbuf	,
	atc		; else force Carry - set		ahl	bx.1	extract pointer to
			, came toron carry - sec		BOY	ax, (bx+dfteb)	date format table
bkt9:	ret		; back to caller		BOY	dfptr,ex	, unto locale capie
cbktlm	endp			getc2:	ret		; back to celler
				getetry	eodp		
hknum	proc	near	; check for valid numeric				
			; field and convert it	TEXT	eods		
			r call with:		end		(Figure Lends

■ POWER PROGRAMMING

verted fields thours, minutes, and seconds) is checked to make sure it has a legal value. We ignore the hundredth-of-seconds field in the SCANTIME routine (even if it was present in the input) since its usefulness in an interactive program is at best problematic. Firally, the hour, minure, and second values are loaded into the appropriate registers and the routine returns to its original ealler.

In the case of SCANDATE, validation of the input is somewhat more complicated. The pointer dTptr, which is set by the getetry subroutine, is, is used by SCANDATE to determine which of the three variables N1, N2, and N3 contain the day, month, and year This allows SCANDATE to date; its operation to the three different date formats that are supported by MS-DOS.

When checking the various fields, SCANDATE first tests the year. If the year value is legal, it is used to update the table daytab (which contains the number of

Other registers preserved

Other registers preserved

days in each month) to allow for 29 February days during leap years. Next, the month value is checked for validity: if it posses, it is used to extract the maximum legal day number for that month from day tab. Last, the day is checked to make sure it is in the acceptable range. Once all these barriers have been crossed, SCAN-DATE loads up the registers with the results and exits.

I may seem to be harping on internationalization issues, but they are meanpaying attention to—especially if you are reddeveloping a commercial product of you're alive to monetary considerations; or remember that the U.S. market is not infinitely large and the competition in most sinnitely large and the competition in most sinches is firere and growing worse. In a coverseas markets are still relatively open and a little time spert on internationalization support may increase your share significantly.

Simply in terms of plain etiquette, just put yourself in the shoes of a European

user who is accustomed to typing his dates with dup first and month second. If your product is good enough, he'll still hoy it will not be compared to the control of the c

A SCANTD DEMO The program TRYSTD ASM (Figure 2) demonstrates use of the SCANTIME and SCANDATE controlled to the SCANTIME and SCANDATE controlled to the SCANDATE, reconverts the share to binary with SCANDATE, reconverts the inhary date to ASCII with devt, and displays it, and goes through a similar two-way conversion and display with SCANTIME asson and display with SCANTIME and the state of th

To use the TRYSTD demo program, you will need the files TRYSTD.ASM and SCANTD.ASM from this issue. TD.ASM (May 31, 1988), and ATOLASM (February 16, 1988). Assemble all of the source files into object files by entering the following sequence of commands:

alone in response to a prompt.

MASH TRYSTD: MASH SCANTD; MASH TD; MASH ATOI:

Then link the object files into the executable file TRYSTD.EXE with

LINK TRYSTD+SCANTD+TD+ATOI;

If you wish, you can create a simple TRYSTD MAKE file (as shown in Figure 3) that will automate the process of building the TRYSTD.EXE demo. Then, whenever you make a change to any of the source files, you can simply enter

MAKE TRYSTD

The MAKE utility will determine which files need to be reassembled, then link the executable program from its component

SCANDATE and SCANTIME Calling Sequence

Calling sequence for SCANTIME procedure

ns-si

Converts an ASCII time string into MS-DO	S binary time format.
Cafl with: DS:SI	= address of string
Returns: Carry	 Set if bad time
	or
Carry	- Clear if good time
СН	= hour
CL	= minute
DH	= second
DL	= hundredths

Calling sequence for SCANDATE	procedure
Converts an ASCII date string into MS-E	OOS binary date format.
Calf with: DS:SI	= address of string
Returns: Carry	= Set if bad date
	or
Carry	 Clear if good date
CX	= year (1980+)
DH	= month (1-12)
DL	= day (1-31)
ne-si	- address ₊ 1 of terminator

= address+1 of terminator

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■ POWER PROGRAMMING

	name titla page	TRYSTD time 55,132	4 deta conversion demo		mov mov cell	si,offeat DGRO hx,8 tort	UF:reg4a
					Cerr	COPE.	
TRIST	D.ASH	demonstrate use	of time and data				; now display time
		and TO ASK	ines in SCANTD.ASH		BOY	dx.offeet DGRO	Urimon4
					BOY	cx.mené lan	-
Promi	de usar	for data end tip	me, converts input		cell	pmsq mainl	
to bi	nery and	checks it for v	relidity, then		j≅p	mainl	; go do date again
CODY	rte bina	ry data and time	back to ASCII	maint			; displey "Bed time!"
for d	isplay.			maint:	mov	dx,offset DGRO	, erebteh .sed frme;
					BOY	cx,mags lan	or maye
70 43	et the	talm quuo biodis	m just press (Enter>		call		
arone	et the	prompt.			imp	meinl	; go do data again
Page 1	uncen +	PC Magazina * Fe	shruary 1966		-		
; may u	ameall .	a majoration . Le	manage and	mein9:	807	ax,4c\$\$h	; final exit to MS-DOS
,					int	21h	; with raturn code-0
cr	aqu	#db	; ASCII carriaga return ; ASCII lina fead				
16	aqu	#ah	; ASCII line feed	mein	endp		
etdin	aqu		; standard input handla	peneg	proc	DAAT	; displey a message
stdout	aqu	1 2	; standard output handle : stendard error handle	,,			call with
regerr	egu	z	; stendard error handle				: DS:DX - Resease
							; CX = length
DGRDUP	group	DATA					
NAME OF TAXABLE	dronb	_WATA			DOV	bx, etdout	; standard output handle
				1	morr	ah, 48h 21h	
TEXT	sagnent	word public 'C	905		int	21b	transfer to MS-DOS
	-				rat		; back to callar
	assume	cs:_TEXT,ds:_Di	A7A	ones	endp		
				bund	Assob		
	axtrn	scantime:near	; convert time to binary				
	axtrn	scandate:near	r convert data to binary	olina	proc	TARE	: gat line from user
	extrn	devt mear	convert time to ASCII	211111	,		
	axtrn	OCALIDESL	; convert date to ASCII				; set DS:DX = buffer
main	proc	Dear			BOT	dx,offset DGRO	
-	brog.				BOY	CX. 55	: CX - meximum langth
	BOY	da, ax	; make our date segment		BOY		
	BOY	de, ax	: addressable	1	BOT	ah,3fh	: function 3FH = read
	BOY	40,4X		1	int	21h	: transfer to MS-DOS
				1	rat		; back to callar
: inian			; display "Enter date"				
	mov	dx,offsat DGRDS	Pineg1	glina	andp		
	BOY	ox,megl_lan		-			
	call	pmag		_TEXT	ande		
				1			
	call cmp	gline	; get data from usar ; ampty line?	DATA	sacres:	t word public 'D	ATA'
	ie .	ax,2	: ves, exit	-	-	-	
	,-		, ,,	megl	db	er, lf, lf	
			; convert the date		do	"Enter e data:	
	BOY	ei.offeet DGRDG	Priboff	megl_l	m equ S	-magl	
	call	scandata			-		
				zeg2	ණ	er,lf	
	je .	main2	; jump if bad data		db	"You entared:	
				neg2e	۵.	"XX/XX/XX"	
			; convert data for output	Beg2_1	in equ S	-mag2	
	BOY	si, offsat DGROU	IF:msg2a	2003	400	cr,lf,lf	
	mov	bx, s		magj	do dh	"Enter e time:	
	cell	devt	; now display data	mag 1	in ago \$	-menl	
	mov	dx.offeat DGROS	(Burney)				
	BOT	cx,mag2 lan		2004	db	or,lf	
	call					"You antered:	
	imp	mein3	1 now do time	ments	60	"XX XX XX"	
				meq4 1	in agu S	-maq4	
mein2:			; display "Red data:"	_			
	BOV	dx,offeat DGRO	77 19495	meg5	0	or,lf	
	mov	ex, mag5 lan		Secret :	ab n +01 5	"Bed date!"	
	call	basid		mag5_1	m equ S	-mag5	
mein3:			; display "Enter time"	ment	4	or,lf	
mdlnJ;	most.	dx,offset DGRO	" orehital .sucet crue,	- my	db.	"Bed time!"	
	BOY	cx,mag3_lan	er -may-	went 1	n agu 1	-ment	
	cell	pmeq lan				-	
	GATT	Sanad		ibuff	db	88 dup (?)	: input buffer
	call	glina	: gat time from user		_		, sapar parrer
	CATT	ax,2	; ampty line?	DATA	ende		
	ia.	mein9	yes, exit				
	14						
			; convert the time	STACK	BACTOR!	t para stack 'ST	ACK'
	mov	si, offset DGRO	Pribaff	Jimes		-	
	cell	scantine			Ф	128 dup (?)	
	je	mein4	; jump if bad time	STACK	anda		
				1	end	main	
			: convert time for output				

Figure 2: Source code from TRYSTD.ASM.

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■ POWER PROGRAMMING

object files, MAKE files look cryptic but are actually fairly simple. The file in Figure 3 contains a series of dependency statements followed by commands. A dependency statement takes the form

trystd.obi : trystd.asm

scantd.obj : scantd.asm

masm /Zi scantd:

td.obi : td.asm

maam /Zi tryatd:

target : source atoi.obj : atoi.asm masm /Zi atoi;

The source may be one or more files. MAKE evaluates a dependency statement by comparing the date of the source file(s) to that of the target file. If any source file is dated later than the target file. MAKE carries out the commands (terminated by a blank line) that follow the statement.

Alternatively, if you have been putting the program modules previously published in this column into an object module library (I'll assume you called it PP.LIB). you can add SCANTD.OBJ to the library and then create TRYSTD.EXE by entering the commands

LIB PP +SCANTD; LINK TRYSTD, , , PP;

As we build more and more programs for this column out of multiple object modules, the advantages of becoming comfortable with MAKE and LIB will become increasingly evident.

THE IN-BOX Please feel welcome to send your comments and suggestions to me care of any of the following e-mail addresses:

BIX: rduncan CompuServe: 72406,1577 MCI Mail: Imi

masm /Zi td; trystd.exe : trystd.obj scantd.obj td.obj atoi.obj link /codeview trystd+scantd+td+atoi;

Figure 3: A MAKE file for the TRYSTD.EXE demo program.

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SPREADSHEET CLINIC



Using the same macros in different worksheets; converting numeric test scores to letter grades; trapping macro errors; calculating Canadian mortgage payments in 1-2-3.

TRAPPING CTRL-BREAK

In addition to trapping other macro errors, the (OnError) command traps the error caused by pressing the Crrl-Break key combination. One useful way to use that capability is illustrated in Figure 1. This embellishment of the ubiquitous "enter and move" macro uses Crrl-Break to bring up a custom menu. The choice you make from that menu determines the direction in which 1-2-3 will move the cursor when you hit Enter.

When Ctrl-Break is struck, execution branches to the cell named \a (the first cell in the macro). The next statement presents the menu. The choice you make determines the direction in which the cursor will move when you press Enter. If you choose Right, Left, Up, or Down, 1-2-3 puts the labels '{Right}, '{Left}, '{Up}, or '{Down}, respectively, into the cell named DIR (B10). The program then branches to the cell named LOOP (B9), where it pauses while you make an entry. As soon as you press Enter, 1-2-3 looks to cell B10, which will contain a command that instructs it to move the cell pointer one cell up, down, to the right, or to the left.

You can continue to make entries until you press Ctrl-Break again, at which point 1-2-3 trips the (OnError) command and routes the execution of the macro back to cell Al. The statement in that cell resets the error-trapping mechanism, presents the menu, and lets you choose Quit to cancel the execution of the macro.

Richard Ruiz Toronto, Ontario Canada Trapping the Ctrl-Break combination is useful in a variety of situations. For example, you may wish to make the user confirm the cancellation of the macro, instruct 1-2-3 to invoke a cleanup routine, and so forth, after he presses Ctrl-Break.

forth, after he presses Cril Break. Unformands/, OhErrod's statements are not error specific: they will trap any macro error that occurs during execution of a macro, not just the ones you want them to trap. You can make 1-23 respond differently to different errors that ir ph (OhError) command, however. To do this you must use the optional second argument of the (OhError) command, which instructs 1-23 to store a message explaining the error that tripped the (OhError)

command in a cell of the worksheet. That way, you can use an {If} command to test the message and route the macro in different ways, depending on the result.

The macro shows in Figure 2 uses this technique. In the vent of one rore, the first statement in this macro cases execution to the cell named TEST (B13) and stores the error message that appears at the bottom of the extrem in teST or check to be cell first part of the extrement in TEST or check to be cell first part of the extrement in TEST or contains the label Break, as it will if you've pressed Cell Break in this very new the state of the extreme the extreme

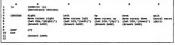


Figure 1: This macro uses an {OnError} statement to trap the Ctrl-Break key combination.

Figure 2: A modification of the macro in Figure 1 that traps only Ctrl-Break.

■ SPREADSHEET CLINIC

the cell pointer. If MESSAGE contains any other label (as it will if an unanticipated error tripped the {OuError} statement), 1-2-3 will simply cancel the execution of the macro

CALCULATING LETTER GRADES 1 use 1-2-3. Release 1A, to keep track of

students' grades in the various college courses I teach. As a part of the grading process. I need to convert numeric scores into letter grades. Since 1-2-3 1A returns a value of 0 for labels, I can't use an (a VLOOKUP function for this purpose. Consequently. I use the macro shown in Figure 3.

This macro calculates the letter grade equivalents of a column of numeric scores. It is invoked while the cell pointer is in the cell immediately to the right of the one that contains the first numeric score. For example, to compute the letter grades for the scores in cells B22..B26 of the worksheet shown in Figure 3, you would invoke the macro while the cell pointer was positioned on cell C22

The first statement in the macro copies the numeric score in the cell to the left of the cell pointer into the cell named SCORE (B18). In the example in Figure 3, if the cell pointer was on cell C22, 1-2-3 would copy the value 73 from cell B22 into SCORE. The next 13 statements deter-

mine the magnitude of the value in SCORE and enter the appropriate letter grade into the current cell, i.e., the cell to the right of the one containing the numeric score.

cur the poi stat nin gra tin the poi wil in S in c

Because the cutoff points for each letter grade are listed in a table, you can change the "curve" without altering the macro. You simply change the values in the second column of the table.

Robert E. Daniels Chapel Hill, North Carolina

This is a good example of a technique that lets you use macros to circumvent 1-2-3. Release IA's unfortunate inability to work with strings. If you use 1-2-3, Release 2. you could use the fiarction

After entering the letter grade into the	
rent cell, 1-2-3 branches to the cell	
ned CONTINUE (B15). The statement	
re instructs the program to move the cell	
inter down to the next cell. The next	
tement sends 1-2-3 back to the begin-	
g of the macro to determine the letter	
de for the next score. The program con-	
ucs in this fashion until it moves beyond	
last row of the table of scores. At that	
int, the cell to the left of the cell pointer	
Il be empty, 1-2-3 will replace the value	
SCORE with nothing, the /xi statement	
cell B2 will be true, and the execution of	
macro will be canceled	

"F"))))))))))	
instead. Of course, with Release 2	

could also use an (a VLOOKUP function.

MACRO LIBRARY LOOKUPS Symphony's Macro Library Manager lets

@IF(B23>=G3, "A",

@IF(B23>=G4, "A-",

@IF(B23>=G5, "B+",

@IF(B23>=G6,"B",

@IF(B23>=G7, "B-", @IF(B23>=G8, "C+",

@IF(B23>=G9, "C",

@IF(B23>=G10, "C-" @IF(B23>=G11, "D+",

@IF(B23>=G12, "D",

you keep your macros in a portion of memory outside the current worksheet. This is particularly useful when you need to use the same macro in a variety of different worksheets You can store more than macros in

macro libraries. I find it a handy place to store lookup tables. Although you can't access the information contained in such a table simply by entering an (a VLOOKUP function into a cell, you can get at it by using a simple macro. Figure 4 shows a lookup table and macro that gives you access to the information it contains. Both the table and the macro can be stored in a macro library, and either one or both can be used in the current worksheet. The macro \w returns the entry from the

second column of the lookup table in cells A2..B5, which is named TABLE. More specifically, it returns the entry that corresponds to the entry in the cell over which the cell pointer is positioned when you invoke the macro. Symphony enters the result in the cell to the right of that cell. For example, suppose that cell B53 of a worksheet contains the label 'W3. If you invoke the macro while the cell pointer is positioned on that cell, Symphony will enter the value 10.42 into cell C53 The first statement in the macro in-

structs Symphony to enter the result of the Let ANSWER function of cell B7 into the cell named ANSWER-the third cell of the macro. The @CELLPOINTER function returns the address of the current cell-in this case, \$B\$53. The (a fa function converts that result from a label into a

	A			c	D	E	r	a .
1	\9	/c(Left) sc	ORE"				Grede	Cutoff Point
3		/xisconz=8"	/xq					***********
3		/xiscore>=G	ij"λ"/×	gCONTINU	E-		Α	93
4		/xiscore>=G	4"A-"/	XCONTIN	UE"		A-	98
5		/xiscorz>=G	5~8+~/	*GCONTIP	UE"		8+	87
6		/xiscore>=G	6"B"/x	gCONTINU	E-		8	93
7		/xiscorE>=G	7"s-"/	XQCONTIN	UE"		8-	99
		/xiscorz>=0	18"C+"/	EQCONTIN	UE-		C+	77
9		/xiscore>=c	9"C"/x	QCONTING	E-		c	73
18		/xiscore>=c	18"C-"	/xqconTI	KUE"		c-	78
11		/xiscore>=c	11"0+"	/xgconTI	NUE"		D+	67
12		/xiscore>=G	12"D"/	XCONTIN	TUE"		D	63
13		/xiscore>=G	13~D-	/xgconTI	NUE"		D-	6.0
14		F"						
15	CONTINUE	(Down)						
16		/xg\g ⁻						
17								
18	SCORE							
19								
28	Student	Score		Grade				
21								
22	Adame	73						
23	Brown	89						
24	Collins	52						
25	Devis	100						
26	Evane	66						
27								

Figure 3: A macro that converts numeric test scores into letter grades.

1 Category Hourly Wage 2 M1 7.99 4 M2 7.89 5 M4 18.42 7 M (Let August 6

(Let Amswer, @string(@vlookup(@@(@cellpointer("addrass")), TABLE,1),2))
(Right)

Figure 4: The macro in cells B7. B10 looks up a value from the table in cells A2. B5. Both the table and the macro can be stored in a macro library.

try from the second column of the table that corresponds to the entry in cell

■ Many Canadians have tried to use 1-2-3's

@PMT function to

cell reference. The @VLOOKUP func- |

tion then returns the value 10.42-the en-

calculate their mortgage payments only to find that the result differs from that provided by their bank.

B53—the label 'W3. The @STRING function converts that value into the label '10.42. Symphony places that label into ANSWER.

The second step of the macro tells Symphony to move the cell pointer one cell to the right—in this case, to cell C53. At that point, 1-2-3 will type the characters to the right of the label prefix in ANSWER (in this case, 10.42) onto the Edit line. The final statement in the macro locks that entry into cell C53.

Robert A. Brennen Tacoma, Washington

For this technique to work, the Macro Library Manager must be attached to Symphony and the macro library containing the lookup table and macro must be in RAM. Its usefulness in a variety of programming situations makes us wish that 1-2-3 supported macro libraries.

CANADIAN CONVERSION

Mmy Canadians have tried to use 1-2-3's @PMT function to calculate their mostage payments only to find that the result differs from the one provided by their bank. U.S. banks compound the interest on mortgages annually, and this is the assumption used by 1-2-3's @PMT function. Canadian banks compound the interest semiannually, however. As a result, the @PMT function returns erroneously high results for Canadian mortgages.

Fortunately, you can calculate the monthly payments for a Canadian mortgage by using the function shown below:

[The above should be one entry.—Ed.] As you'd expect, PRINCIPAL is the amount borrowed, RATE is the annual interest rate, and TERM is the term of the loan, in years. An unakered @PMT function returns the value \$537.30 for a 15-year, \$50,000 loan at 10 percent. The result with the adjusted formula is \$531.13. Michael Williamson

Halifax, Nova Scotia Canada

Mr. Williamson's formula should be useful for our readers north of the border.

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■ PAUL SOMERSON

User-to-user



A handy program that lets you define and print as much of the screen as you want with the DOS PriSc function, giving DOS added flexibility while saving you time and paper.

PARTIAL PRINT SCREENS

When I'm debugging a program or working on a spreadsheet, I often need to use the DOS Shift-PrtSe function to print out just a few lines of code or some current figures. More often than not, this results in a large amount of wasted paper.

To solve this problem, I wrote PRNBYLIN.COM, created by the PRNBYLIN. ASM assembler listing in Figure I or the BASIC PRNBYLIN.BAS program in Figure 2. This TSR program takes over control of the DOS print screen function.

Now I can select the exact lines I want to print without having to print the entire screen. When in the 80-column mode, you can move the selection bur by using the Plus and Minus keys on the number pad and mark your position by pressing Enter. The program uses DOS's normal print

: PROPETLIE - As	H 7011	ell W. Fowell			CALL	ATTR	show melection bas
PROBULTS . AS	or in a manual	ry resident program that	1love you	GETKEY	102	AN.AH	rest hey
to print one or more lines when using <shft>-<prtsc>.</prtsc></shft>					INT	268	
					CMP	AN. 1CH	steet for coto
Assemble an	d link with	MASK, then orests . COM f.	ile osina		JE	SELECT	
BEEFFE IN					CHT	AN. 4AN	steat for cox
					JE	PGUP	
rest up inst	elletion of	TER			CHP	AH. 21	ctest for cases
CSEG	PROMEST				JE	ENDIS	reult
	AREUNG	CHICSEG, DRICERS, ESICEES			CHP	AE. 488	steet for c->
	ORG	91968			JHE	GETAKY	
FTART (700	INIT		PGD#1	CHP	CL, 24	prove bar down
IRUPT	244				JE	GETERY	
18971	the				CIO	CH, CL	
CURPOS	DMF				JHE	9001	
					CALL	ATTR	
					180	ca	
MATEL	PURR	92	serve registers	PSOl:	INC	CL.	
	PURM	AX			CALL	ATTR	
	PORE	BX			JIO?	GRIERY	
	PORM	CM		SELECT:	COOP	CH, CL	;get line positions
	PUSE	08			200	PRIFT	pmed print
	PORKE				CIO	CL,24	
	PORT	CE			78	PRIFT	
	POP	DB			1BC	CL.	
	MOV	AK. 00500	icheck if PrtSc is		CALL	ATTR	
	MOV	ES.AS	rentive		2502	GETREY	
	CMP	SYTE PTR ES: 000001.01		POUP	CKP	CL. 0	smove bar up
	22	ENDH			78	GETKEY	
	MON	BYTE PTR ES-1868601.61	-make Princ ective		CALL	ATTR	
	MOV	AH. 97%			CHEP	CS, CL	
	197	188			29.0	P001	
	CKP	AL. 3	; check for 60-col mode		DEC	CH	
	21.8	SAVECUR			DEC	CL.	
EXCIT	POPT		preturn to \$106 Prise		2367	PGU2	
	POP	26		PGD1:	DEC	CL.	
	POP	cx			CKP	CL, Cs	
	POP	ü			J1818	GETHEY	
	POP	M.			INC	CL	
	200	98		P9921	CALL	ATTR	
	2007	FAR (DRUPT)			3307	GETKET	
SAVECUR:	909	All. 3	seeve cursor position	PRINTS	HOV	DH, CH	
	187	188	, posterou		503	CL, CH	rest characters an
	HOV	CURPOS DA			XOR.	CH, CH	peend to printer
	208	CX.CX			INC	CX	
	MOV	DX.CX		PREC:	2058	CX	
	HOV	All. 2			MOV	CL,DH	
	THY	100			CALL	ATTR	
							COMM

Figure 1: PRNBYLIN.ASM, the assembly language source code for PRNBYLIN.COM, takes control over the DOS print screen function and lets you print as many lines as you want from the screen.

	CALL	2907		29871	2043	cx	incister output
	THE	G.			MOV	be, cs.	sporting
	2027	98.CL			2000	96. DL	,
	202	ca			mov	CX. 00	
	1007	2001		27214	2000	es.	
ment .	MON.	DX, CURPOS	preset cursor and		MOV	AN.2	
20011	907	AH. 2	pretura		2397	100	
	197	100	,		MOST.	AR. 6 '	
	MOV	STTE PER RE-(00000),000		1	1307	186	
	7077			I	25204	nor	
	202	0.0		1	xon	DE.DE	
	POP	ex		l .	200	AN, AN	
	202			1	Der	176	
	202	AN		1	200	DOK	
	707	nos.		l	XXC	DL	
	TRET			l .	202	ca	
ment#+	CALL	ATTR		l	1,000	PTRA	
	2000	ment		ı	PORM	DIE	
ATTEL	2000	cx	oet current	I	208	DIE, DIE	
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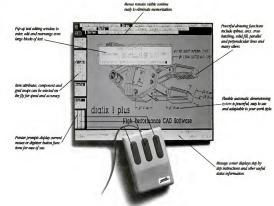
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338 DATA 84,82,CD,18,84,88,CD,18,88,F4,F7,8A,DC,84,89,89,286,3
348 DATA 81,89,CD,18,FX,CZ,59,82,X6,59,C3,51,8A,F1,32,09,2813

358 DATA 89,58,88,51,84,82,CD,18,84,88,CD,18,52,33,D2,32,3553

378 DATA 17,33,D2,88,8A,88,CD,17,5A,59,C3,88,85,35,CD,21,1568

368 DATA 89,18,83,81,80,86,85,81,8A,89,81,88,85,25,00,21,983

Figure 2: When run once in BASIC, the BASIC program PRNBYLIN.BAS creates PRNBYLIN.COM, which takes control over the DOS print screen function.

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Russell W. Powell Boston, Massachusetts

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POWER USER



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PROPORTIONAL WP ON HP

WordPerfect users who have been unable to get microspacing when using proportional forts with a right-justified margin on their Hewlett-Packard Laserlet Series III printers should change the factory-ecommended 13* to 15*. Although other users may prefer different margins, I have found that 15 and 108 produce a very nice appearance.

Since I most often use the Helyetica 10point type style, I defined that as Font 1 in my Helvetica download file. I decided to change my defaults to reflect the settings I use most frequently, as well. To do this, type WP/S at the system prompt. Select 2 to set initial setups. Choose Line Format (Shift F8). To change the margins, press 3, Enter, then 15, Enter, 108, Enter. Select Print Format (Control F8), Press 1, then 15*. If Font 1 is the desired default, press Enter, Enter. Otherwise, press Enter, font number desired, Enter. If you wish to choose a different printer number as the default printer, choose Print (Shift F7). Press I, give the new printer number, and Enter. Zero ends the setup. If you use a proportional font most of the time, changing the initial setups will save lots of time.

For soft font users, World erfect has an HP Utility Disk (51) that provides Word-Perfect 4.2 and Hewlett-Packard Laserlet 4.2 and Hewlett-Packard Laserlet Perfect 4.2 and Hewlett-Packard Laserlet Perfect Printer 1 disk. A six-page memo takes the user through the procedures needed to download the HP soft fonts, use the soft-font printer definitions supplied by wordPerfect, and create a custom soft-

font printer definition. The information is easy to follow and the printed results excellent. For information on how to obtain the HP Utility Disk, call WordPerfect at (800) 321-4566.

Jan Duke Lawrenceville, Georgia

You can configure almost all of the default settings for WordPerfect in the WPIS sengmenu. If you set any of these by hand each time you start a document, consider simply making your preferred values the defaults.—Neil J. Rubenking.

EXAM TIME WITH WORD

Teachers who create multiple-choice exams with separate answer sheets can make good use of *Microsoft Word's* footnote feature to create multiple versions of the tests to prevent conving.

When creating the original exam, Test A, use the Format Footnote command to

■ Teachers who create multiple-choice exams can make good use of Word's footnote feature to create multiple versions of tests to prevent copying. automatically number the questions. Place the cursor and type

<Esc>F(format)F(ootnote)

Then enter the answers at the end of the text as "footnotes," and use the Jump Footnote command to return to the main body of the document.

When you now move the questions around to create Test B (copying and inserting on a copy of Test A), Word will automatically renumber both the questions and the answers, giving you a properly numbered answer sheet to each version of the test.

Stephen W. Hartman Smithtown, New York

Also be sure to use a different header on each version of the test, to avoid confusing the two.—M. David Stone

MORE dBASE III PGDN IDEAS

To Dana Forsberg's routine for saving editing keystrokes when moving the cursor to the same field every time (Power User, November 10, 1987), I suggest adding three other nonprogramming techniques I have found useful.

If Pay is the field you want to edit, for example, you can display and edit it one record at a time by entering

EDIT FIELD Pay, Id, Name

EDIT FIELD is the same as EDIT except that only the fields you specify will be presented. These are presented in the order you list them, and the field you want can be placed on the top line.

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The compilers are presently available in two formats: Microport Unix 5.3 or MS-DOS as extended by the Phar Lap Tools. MicroWay will port them to other 80386 operating systems such as OS/2 as the need arises and as 80386 versions

The levy to addressing more than 640 bytes is the use of 250 hirtegers to address arrays. NDP Fortran-366 generates 32-bit code which exocutes 3 to 6 firms faster than the current generation of 16-bit completes. There are three elements each of which contributes a factor of 2 to this speed increase: very efficient use of the contribute of the contribut

An example of the benefit of excellent code is a 32-bt matrix multiply, in this benchmark an NDP Fortan-386 program is not against the same program compiled with a 16-bt Fortan. Both programs were nut on the same 90396 system. However, the 32-bt code ran 75 bt mes tester than the 16-bt code, and 55.5 times feater than the 16-bt code is securing on an IBM PC. NDP FORTRAN-386*

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■ POWER USER

Another way is to use the command

which presents a group of records (10 or 17, depending on the F1 key) with editing access to the Pay field only. The fields are listed in the order you specify.

In other situations, luse

SET FIELD TO Pay, Id, Name

Then, by using SET FIELDS ON/OFF, you can toggle between the restricted field list and all fields for editing, browsing, displaying, listing, or printing. One drawback of SET FIELDS, however, is that (unlike the first two commands) it does not change the order in which the fields are presented.

James H. Fraser San Diego, California

There's nothing like having an arsenal of slightly different ways to do the same thing, so you can choose the best for each situation. Note, however, that Mr. Fraser's third suggestion, SET FIELDS, was not available before dBASE III Plus.—Brad Stark.

FASTLINE

<Ctrl-F10>

<Alt-196>

<Ctrl-F10>

<Down><Down>

<Home><Home><Left>

<Alt-L>

<Tne>

(Rac)

The WordPerfect line draw mode is very adown, so I developed a macro (Figure 1) that will quickly draw hortcontal lines of any user-specified length and number. You must type your text on every other macro. The macro draws the line and save it hefore using the macro. The macro draws the line and moves down two lines using the Down key, so the vertical lines must be created first. This method of drawing lines is much faster than using line draw, especially when you need multiple lines.

To use the line-drawing macro, follow

the instruction sequence below:
(1) Move cursor to position where first

line will start.
(2) Press the Esc key, type line length,

and press <Enter>.

(3) For multiple lines, press Esc again and type the number of lines.

(4) Hit Alt-L. For example, if you want to draw two lines of 34-character length, you would press the following keys:

Esc 34 Enter Esc 2

Esc 2 Alt-L

Bob Chitaroni Sudbury, Ontario Canada

Mr. Chitaroni's macro inserts lines between rows of text that you've already written. If you want to create the lines first and then type the text, eliminate the

<Home><Home><Left>

and replace the <Down>s with <Enter>s. If you want double lines, replace Alt-196 with Alt-205. Do be sure to follow the author's advice and save before using the macro. A mistake in using it could wipe out large parts of your text. —Neil J. Rubenking

WORD AS WORDSTAR

Hold down ALT, hit 1-9-6 on keypad Go to start of line

Begin macro definition

Turn on Typeover mode

Go down two lines Turn off Typeover mode

End macro definition

Call it Alt-L

Repeat

The fatal flaw in Robert Matthews's attempt to use Microsoft Word macros to emulate WordStar commands (Power User, January 26, 1988) is that after typing the command, there is a substantial delay before the Word macros begin to execute. H

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Figure 1: A fast way of drawing lines in WordPerfect.

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5:00 66 Susan-Good work on that mailing.



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■ POWER USER

This time lag increases as you move toward the end of a file, reaching up to 25 seconds with a 35K file on a standard PC. Worse, if you don't wait out the delay, you run into the problem that keystrokes are not buffered to take effect after the macro. Since the whole point is to let well-trained WordStar adepts continue their old habits, I suggest that Word's macros are unacceptable substitutes except on short files.

All of my old ProKey macros work on Word 4.0, however, and this provides a partial solution. Unfortunately, ProKey can't emulate WordStar completely because it has only single-key macros. Allan Fries

Seattle, Washington

Yes and no. The delay in executing Word macros is real, but it is not nearly the problem Mr. Fries suggests. The increase in delay is not a function of how far you are from the beginning of the file, but how far from the beginning of the current page. And the solution for speeding up macro execution as you move through the file is simply to repaginate the document.

On the other hand, even at the beginning of a page there is a small delay between typing the macro and getting a response. While the delay is tolerable (at least on an AT or better), it is anything but desirable. What's more, it is most likely to be a problem on the single-key cursor key commands, where you will often want to type several cursor movement commands quickly, one after the other. For these, as

The delay in executing Microsoft Word macros is real, but it is not a substantial problem.

Mr. Fries notes, you can use ProKey (or any other macro program), and more interesting, you can use the macro program for single-key control-key commands and still use Word macros for two-key controlkey commands.

Note that if you type a Ctrl-key combi-

nation that isn't defined as a macro in the macro program, the program will simply pass the keystroke on to Word. If you do accidentally define the same keystroke as a macro both in Word and in the macro program, the latter will intercept the keystroke and Word will never see it.

-M. David Stone

PRINT MACROS IN WORD

In his review of Microsoft Word (PC Magazine, December 8, 1987), Edward Mendelson presented a macro for printing the page on which the cursor is currently located. Although useful for this purpose, the macro unfortunately leaves the Printer Options set to print only a specific page. As a default, it's generally more useful to print all the pages in the document. The following modification of Prof. Mendelson's macro resets the Printer Options to the default of printing all pages:

<Zec>jp.eet pegenumber = field<<Enter>
<Zec>po<teb 6>p<teb>.pegenumber.Enter>p
<Zec>po<teb 6>e<Enter><Zec>

Robert D. Gill Brooklyn, New York

Several readers suggested similar changes; Mr. Gill's was the first letter received. As an alternative approach, consider the following macro:

<Eec>po<left 2>y<left><up><pauee <<Enter> This queues the file, then shows the options menu with the highlight in the "range" options. More generally, you can use this approach to create a default set of print options, then have the macro stop and wait for further instructions. If the defaults are appropriate, simply hit <Enter> <Enter> to print. Otherwise, adjust the

options as needed .- M. David Stone SHARE YOUR POWER

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LANGUAGES



Speeding up point plotting with EGA_GRAPHICS; simulating structured function returns in Turbo Pascal: minimizing BASIC's cumulative calculation errors.

BASIC

A NONEXISTENT NUMBERS FIX

The problem of "IBM's nonexistent numbers" (Languages, PC Magazine, January 12, 1988) also plagued me until recently. The software I write performs amortization calculations using nested loops (95 years by 12 months), and the compounding of erroneous numbers causes large discrepancies after 1,140 iterations.

One solution is to perform all calculations using double-precision variables and numbers. Though double-precision math is decidedly slower, the results will be much more accurate. Unfortunately, if many numbers must be stored in a disk file, twice as much space will be required.

I have discovered that storing numbers in single-precision variables on-disk is often sufficient, as long as they are converted to double precision using a combination of VAL() and STR\$(). Notice that simply assigning a double-precision variable from one of single precision will not eliminate the error, as illustrated in Figure 1.

> Iim Thomson Houston, Texas

Cumulative calculation errors have plagued programmers for years. Several other readers wrote to point out that double-precision variables will help with this problem, though even that approach isn't perfect. Your use of STR\$() is clever, and it does cause some useful rounding to be done by BASIC. Several other rounding methods have also recently appeared in these pages.

When only addition or subtraction is required on a large group of numbers, the best solution is to use lone integers. Both Turbo Basic and QuickBASIC 4.0 support long integers, which accommodate whole numbers between plus and minus 2 billion. If you're dealing with dollar amounts, the values could be considered as pennies and the appropriate conversion made when the results are printed.-Ethan Winer

TURBO PASCAL

STRUCTURED FUNCTION RETURNS The Jensen and Wirth Pascal User Manual specifies that a function result must be a scalar, subrange, or pointer type. Turbo

Pascal extends this specification by allowing strings. But you can't create a function that will return an array, a record, or any other structured type. However, with some minor trickery you can come very close. The program in Figure 2 shows a func-

tion that returns the complex product of two complex numbers. The trick here is that it returns that product as a string. With TP4's typecasting facility, it's a snap to refer to that string as the RECORD type it really is. Note that you have to add a dummy length byte at the start of the structure and set it to an appropriate value. With this minor addition, you can program almost exactly as if your function returned a complex result directly.



Figure 1: A comparison of single- and double-precision calculations. (\$R-,S+,I+,D+,T-,F-,V+,B-,N-,L+) (\$M 16384,0,655360 } PROGRAM ComplexDem L: byte; (dummy length byte) R, I: Real; (real and imaginary parta) CompStr = STRING[12];

Figure 2: Demonstrating a way to simulate structured function results in Turbo Pascal.

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■ LANGUAGES

```
FUNCTION ComplexHul(A.B : Complex) : CompStr:
   VAR Temp : Complex;
   BEGIN
      Temp.L := 12; (set the dummy length byte)
Temp.R := A.R*B.R - A.I*B.I;
       Temp.I := A.R.B.I + A.I.B.R
      ComplexNul := CompStr(Temp); (typecast)
   END:
   C3 := Complex(X);
   WriteLn('Enter lat complex number, real part first. E.g. "2.5 5.8"');
   Write(':'); ReadLn(Cl.R, Cl.I);
  writein('Enter 2nd complex number, real part first. E.g. *2.5 5.8");
write(':'] ReadIn((2.R, C2.1);
Compstr(C3) = ComplexNul(C1,C2);(typecast)
RriteIn('Pheir product is ',C3.R;ili,' * ',C3.I:i:ll,'i'];
                                                                                                     (Figure 2 ends)
END.
PROGRAM EGA_GRAPHICS; { primitives for fast color graphics in TURBO PASCAL. ]
    RegPeck = RECORD
                     AX, BX, CX, DX, BP, SI, DI, DS, ES, Flage : Integer
   AR
RegPek : RegPeck;
{ Next 4 erreys evoid repetitive calculations }
xeddr : ARPAT(8 - 6.38] OF myte;
Yeddr : ARPAT(8 - 6.39] OF integer;
Point : ARPAT(8 - 6.39] OF byte;
   HiPoint : ARRAY[8..649] OF I
I, J, Color, Left : Integer;
dummy : Cher;
   PROCEDURE Init graphics(BackGround : Integer);
(Sets up graphics hardwere and srreys to svoid repetitive calculations.)
    BEGIN
       PortN($83CE) := $1883; { Use XOR for writing to graphics memory $1663 for OR. } { Por Color machines let RepPak.AX:= $8016, Mono = $8887 }
          gPek.AX :- $8810:
       Intr($10, RegPak);
                          TO 349 DO Yaddr[indx] := 27928-88*indx
       con indx := 0 10 409 DO Tedar[indx] ?= 2/920-001indx;
{ Subtracting from 27920 makes origin at the lower left corner. }
POR indx := 0 TO 639 DO Xeddr[indx] := indx DIV 6;
FOR indx := 0 TO 639 DO
         BEGIN
           Point(indx) := $88 SER(indx MOD 5);
HiPoint(indx) := Swap(Point(indx))+8;
      GrephBeckground(BeckGround); ( Stenderd TUBRO works fine here )
    PROCEDURE Plot(x, y : Integer);
      total, junk : Integer;
      total := xaddr(x)+Yaddr(y);
PortM($#3CE) := HiPoint(x);
                                                     Pind sequential address ]
                                                      Protect bits in meak )
       Junk := Men[$A888:Total];
       Junk := Mem[$A888!Total]; ( Latch bit planes by reading )
Mem[$A888:total) := point[x]; ( Light up pixel )
   PROCEDURE PixelColor(Color : Integer);
      FortW($83CE) := SFF81; { Enable set/reset }
PortW($83CE) := Swsp(Color); { Set color of Pixel)
             URE WriteAgein(BackGround, ForeGround : Integer);
      ( Reloads 6x14 font )
   BEGIN
      RegPak.AX := $1101;
       RegPak.Bx := $8082;
      Intr($18, RegPak);
{ Set new background and foreground colors }
GraphBackground(BackGround);
```

You can do this trick with almost any structured type. I hast add the length byte to the structure and make sure the string type occupies the same number of bytes. How your function calculate the desired result and typecast it to a string. Then the program line that calls the function repressits it back to the structured type. That's it!—Neil J. Rubenkine

FAST EGA OUTPUT

The demo program EGA_GRPH.COM, written solely in Turbo Pascal, Version 3.0, (see Figure 3), has full color support for the EGA. It puts pixels to the screen 3.1 times as fast as MetaWINDOWS and 3.5 times as fast as MetaWINDOWS and 3.5 times as fast as the standard Turbo Pascal Plot procedure (which won't work on the EGA in 640 by 350 resolution). You can

EGA_GRAPHICS's speed comes from using arrays and from writing directly to video memory and EGA registers.

use EGA_GRAPHICS alone or with the monochrome graphics primitives (Draw a line, Circle, and ScreenDump for hard copy), also in Turbo Pascal and published in PC Tech Journal (September 1985, page 163).

The speed comes from using arrays to avoid repetitive calculations and control repetitive calculations and embedding directly to the video memory and the EGA registers. Also, with just one statement you can both write to a data registers of the embedding of the

After writing to the EGA registers, the 8 by 14 font is wiped out. Before you use the standard Turbo Pascal WriteLn and

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Writed: Otherwise tenders wite end writedn does not work.'); writedn writedn write end writedn does not work.'); writedn writedn writedn; writedn; end writedn and the writedn

FOR I := 8 TO 349 DO Flot(J+I, I); PixelColor(Random(16)); FOR I := 8 TO 349 DO Flot(Abs(388-I-J), I); EMD;

writeAgain(Blue, Yellow); writeAgain(Blue, Yellow); writeEn('Reloed font egaio with WriteAgein before WriteEn'); WriteEn; writeEn'(Strike any kay to exit.'); Reed(Kbd, dummy); FatMode(CeB); Write statements you must reload it. The procedure WriteAgain accomplishes the font reload and lets you change the text background and foreground colors.

Vic Mansfield Burdett, New York

I like the trick of calculating the offsets for X and Y values once and putting them into an array. If you're going to plot a lot of pixels, the time savings is immense! —Neil J. Rubenking

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PC TUTOR



Coping with the wear and tear of the power on/off cycle; getting extra power using NEC and Intel chips in tandem; making new ATs boot up with NumLock off and cursor keys working.

CREATING ASCIL FILES

I had difficulty converting a DEBUG script from one of your previous columns into a .COM file. DEBUG refused to accept an ASCII file that was created using WordPerfect. When I created the file using the COPY CON command, DEBUG ran with no problems. I've previously encountered the same difficulty with batch files I assembled with WordPerfect. What's the problem?

Yvan Huneault Montreal, Quebec Canada

DOS and DEBUG understand only pure-SXCII files. Most word processors, Word-Perfect included, embed non-XXCII codes into their files to represent special formating. DOS can't understand these codes, and the results are unpredictable. Any word processor worth the floopless if sold on should provide a method for converting a formattee file into a pure-XXCII test file. To do so in WordPerfect, sue the CIP. Exp combination to swe the file as a DOS test file in XXCII format.

PC POWER PROBLEMS

I use a PC with a 20MB hard disk installed. Often, during the course of my work session, I have to leave the machine for a period of time. What length of time would you recommend as the point when turning a hard disk PC off is better than leaving it on when you need to interrupt your use? I trealize that turning the power on creates wear, but so does the continuous rotation of the disk. If I plan to return in I hour,

would it be better to leave it on or to turn it off and power-on again when I return?

> Leonard C. Herr Christiansburg, Virginia

The answer to this question is an unequivooil "id depends." I've always believed that the current surge and electronic shock caused by the power oxiviff, cycle does more harm to computer components than continuous operation. Keep in mind that the power oxiviff cycle shocks all components, not just the hard disk. Men to boards, CPUs, and displays are all subject study of the components of the compotants of the components of the compotence of the components of the components of the compotence of the components of the components of the compotence of the components of the components of the compotence of the components of the compone

When I leave the PC Magazine offices, I turn off the peripherals (monitor, printer, etc.) but leave the PC system unit in my office on continuously. The main reason is convenience. To be able to use my office

 Any word processor worth the floppies it's sold on should provide a method for converting a formatted file into a pure-ASCII text file.

PC while home, it must be turned on and connected to a modem. And should the computer break, PC Magazine would, of course, pick up the repair bill.

At home, however, I take a different tack. When I need my machine, I turn it on. When I don't, I turn it off. During dinner breaks, which last about an hour, I'll leave the machine on, just blanking the display screen. If I'm going to be away longer than that, or maybe not return at all, I'll shut the computer off.

In each case, however, if I'm not using it, I park the hard disk heads. This is probably the simplest and most important thing you can do to protect your computer while you're away. If the power fails, or you turn it off, the head will land safely away from your data.

MIXING PROCESSORS

I recently purchased an Intel 8087 numeric coprocessor for my PC. Before I installed it, I called Intel to check if it was safe to use the 8087 with the NEC V20 I was currently using. Alas, Intel said it was a bad idea and that I should dig out my old 8088 for use with the 8087. Why won't the V20 work safely with the 8087?

A. Kristian Dekom Ringwood, New Jersey

Not having been party to your conversation with Intel, it's hard to speculate as to why its staff said the V20 was incompatible with the 8087. Perhaps it's somewhat like calling IBM and asking if you can put a Compaq disk drive in your PC—I have a feeling IBM would also say it was a bad

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CIRCLE 110 ON READER SERVICE CARD

idea. As for working with the 8087 math coprocessor, the V20 should present no problems. I have run this particular com-

After we got used to the original PC and AT keyboards, on which the number pad defaulted to the cursor keys, IBM did us dirt again when it made NumLock default to on.

bination for several years in my PC with no ill effects of any kind. The real question about the NEC chip is, why didn't Intel think of it first?

Originally popularized as a fast replacement for the 8888, the NEC V20 is actually much more. First, the chip use CMOS (Complementary Metal-Oxide-Semiconductor) construction. This allows it to run cooler and trave less power to run cooler famour especially proportion to manufacturers and users of lapsepcomputers. Less power consumption means smaller, lighter computers that can run longer on a state batter charge.

But while lower power use is important to laptop users, the V20 holds significant advantages for desktop users as well. For example, one of the slower operations on the 8088 is calculating the effective address (EA). Whenever data is moved to or from memory, the correct place in memory must be determined. Often this involves using segment register math and implied indexing. The 8088 performs this calculation by executing many small steps (microcode instructions) internally. This takes time. In contrast, the EA calculation in the V20 is performed rapidly in hardware. This is one reason PCs with a V20 installed return such a high number using The Norton Utilities' SI test.

Besides adding the EA hardware, two major improvements were mode to the ma-

chine instructions. In addition to executing the 8088 opcodes, the V20 will directly execute all the 80286 real-mode opcodes. This means that compilers and assemblers that offer the option can be set to compile for the 80286 and still execute on the V20. Note that protected-mode code (like OS/2) is not supported.

The second improvement isn't widely known or used in the IBM PC world. The V20 can be switched into 8080 compatibility mode. Thus, with the proper setup software. PCs equipped with a V20 can directly execute programs written for the older 8080 CPIM computers.

UNLOCKING NUMLOCK Perhaps the simple question 1 have has

been answered before. My IBM PC AT boots up with the NumLock on. If I forget to turn it off before going into some of my applications, like APL, that change the key assignments, I'm stuck! What can I add to my AUTOEXEC.BAT file to turn NumLock off at the start?

H. Martin Weingartner Nashville, Tennessee

After we get used to the original PC and AT keyboards, on which the number paid defaulted to the cursor keys. IBM did as defaulted to the cursor keys. IBM did as der note egains when it made NumLock default to on. Fortunately, there is a clean, simple fix for the problem. Figure 1 shows a program you assemble with DEBUG to create NUMLKOFF.COM. Running the program will set NumLock off regardless of its present state.

The status of the shift indicators is kept at 0000:0417h, a byte in the BIOS data

```
N NUMLKOFF.COM
A 198
POP DE
AND BY [417],DF
INT 28
C
W
U
```

Figure 1: Type these instructions into DEBUG to create the file NUMLKOFF.COM. Be sure to include the blank line after the INT 20.

Shift Status Byte Encoding 7 6 5 4 3 2 Right Shift Insert mode CapsLock Left Shift NumLock ScrollLoci Alt key The shift status byte, located at 0:417h in the BIOS data area, reflects the current status of the keyboard toggle states and the positions of certain shift keys.

area in low memory. Each bit in this byte reflects some piece of information about the shift state of the machine at that instant. The contents of the byte are labeled

NUMLKOFF shows

just how simple a program can be under DOS. The entire thing can be created in about 15

seconds.

with their meanings in the diagram "Shift Status Byte Encoding.'

NUMLKOFF shows just about how simple a program can be under DOS. The entire thing can be created in about 15 seconds. (The OS/2 version is still compiling!) The POP DS instruction loads the DS register with a zero that was placed on the stack by DOS. NUMLKOFF then simply forces bit 5 to zero by masking it with the value DFh (110111111 binary). The INT 20 instruction terminates the program and returns you to the DOS prompt.

SNOW REMOVAL

Many articles and books have discussed the causes of the video interference

("snow") you see on many color monitors when a program writes directly to video memory. To avoid snow, it's always recommended that characters be written only during "retrace" periods. The articles, however, always seem to stop short of explaining the exact procedure required to accomplish this. Could you please indicate a good

source for this information? Tancredo Ortega

New York, New York

At the risk of seeming biased, I believe you already have one of the best sources of technical information and examples in your hand-PC Magazine. In PC Lab Notes, in the October 13, 1987, issue, Ethan Winer explained the technique for preventing snow on CGA display adapters and presented assembly code examples showing how to implement it. The subroutines listed were designed to be called directly from BASIC programs, but the techniques are applicable to any language.

ASK THE PC TUTOR

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here. drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally.

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CONNECTIVITY CLINIC



High-performance networks tend to have dedicated file servers, but it is possible to increase throughput on your peer-to-peer network while keeping it cost-effective and flexible.

NETWORK SPEED

Our firm has six IBM PC ATs and a Compaq Deskpro 386/20 on an IBM PC Network using Version 1.10 of IBM's PC Local Area Network Program. I am beginning to realize how painfully slow this system is, especially when using shared databases.

We want to add another computer to the network, but we've learned that IBM no longer manufactures the network adapter card we need.

We have our software set up so that each PC can access information from portions of every other PC's hard disk, so software that requires a large centralized file server, such as NetWare, is something we would rather not invest in. We have a network capacity of 320MB spread throughout the system and don't want to invest in a file server with one large disk.

Ideally, we would like a system that obesn't involve a tremendous hardware investment in boards for the individual PCs and allows us to use the PC Network coaxial cable we have already run to our 22 offices. Some of our attorneys have Macs at home, so we are also interested in network compatibility for Apple products. And we would like to see a substantial increase in life transfer socied with the new network.

The research I've done so far seems to point me toward the IBM Token-Ring Network, but I'm afraid of being (expletive deleted) by IBM again. I understand IBM's PC LAW is now on Version I.2, but I can't seem to find anyone who can tell me if it is any better than the older version. When I call IBM, they tell me to call a local dealer who can't seem to get any information out of IBM.

> Rick Leeper Austin, Texas

What a perfect letter for this connectivity blockbuster issue! Mr. Leeper, your letter gives me an excuse for taking the space to lay out some facts, and my opinions, about networking software and performance. I have some good news and some suggestions for improvement.

First, IBM never made its now-defunct PC Network cards. They were, and are, made by Sytek Corp. Sytek will provide you with more cards and anything else you need to keep the network operational. The Sytek 6120 card is an improved version of the IBM network adapter card that you're

currently using in your machines.

Accommodating the Macs calling from home is easy, too. At night, set up a PC

workstation running Remote or Carbon Copy. Both these programs can communicate with any kind of computer dialing into them, so the Macs will be able to use the network resources. It is much better to send keystrokes and screens through the phone lines than trying to exchange data packets.

That is the end of the good news. The bad news is that after testing every

network operating system we could lay our hands on, we found that LAN operating system software falls into Wood istinct categories: high performance with a dedicated server and mediocre performance on a peer-to-peer, or nondedicated, system.

Network Throughput

Configuration	Seconds	per second
10-NET alone	1,190	103.2
10-NET plus RAMdisk	790	155.5
10-NET plus cache	1,100	111.7
10-NET plus Awesome I/O	964	127.4
10-NET plus BatRAM	814	150.9

This table shows the time required for each configuration to perform a mixed set of read/write tasks using sequential and random patterns. 10-NET networking software and 10-NET cards were used with various options. Expect similar results with other well-behaved peer-to-peer network operating systems.

The configurations are listed in increasing order of cost, which corresponds with decreasing order of ease-of-use. The results indicate that more expensive is not necessarily more effective.

■ CONNECTIVITY CLINIC

As your letter points out, peer-to-peer systems are flexible and economical. They work beautfully in office workgroup situations like yours. But the high-performance peer-to-peer resource-sharing LAN oper-

ating system you ask for is a contradiction in terms—high-performance operating systems rely on a dedicated server.

It is very clear that the rated transmission speed of network interface cards is

much less important in determining network throughput than the speed of the network operating system software and the disk drives. Using the same 8-MHz IBM PC AT as a server, software allowing nondedicated operation averages throughput in read/write activities that ranges (within in read/write ranges (within)

aux arves. Using the same 6-M121 LtbM PCAT as a server, software allowing nondedicated operation averages throughput in readwrite activities that ranges (within about two standard deviations of the mean) from 90 to 170 kilobits per second. Software requiring dedicated operation (NetWax, VINES, 3+5 Share) averages a throughput of between 260 and 450 kbps.

You can get improved throughput of about 50 percent by operating from

a RAMdisk.

throughput to vary within a certain range, but the network operating system and the disk drive on the server set the range.

Since you want to keep the flexibility of peer-to-peer networking, there are several things you can do to improve performance. (The results of our lab using, using the 10-NET peer-to-peer operating system in various configurations, are summarized in the table "Newton Throughput," which lists the times in ascending order of cost and practicality.)

der of cost and practicality.)
First, install a RAMdisk on the servers
and put the heavily used data flies in the
RAMdisk. This means you must install lots
of extended memory in every server and
follow strict administrative practices to
copy data from the RAMdisk before shuting down. You can expect improved
throughput of about 50 percent by operating from a RAMdisk.

Second, when files are too big for a RAMdisk, install a disk each program. Of many disk-caching programs on the market, 10-NET has the best we have seen. Using 10-NET's disk-caching program resulted in an average 10 percent improvement in random read/write tasks (more on sequential reads). Of course, you loss RAM to the disk cache, but you can put the cache in extended or exanded memory.

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User defined categories of accounts

Establish a budget



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You cannot add several of these options to accumulate the gains of each option. For example, using both the Awesome I/O and a cache on the network is likely to trash the system.

Finally, some advice about tuning the network. The most primitive but effective method of "iuning" a peer-to-peer network is to arrange the files so that as little data as possible is pulled through the network. Keep as many application programs and private data files on focal disks as is practical and use the servers only for data vour must share.

NETWORK YOUR QUESTIONS

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ADD-ON-BOARDS 405	BUSINESS TIME MANAGEMENT	MULTI-USER SYSTEMS	ACCESSORIES 425
CABLES 405			BAR CODING 425, 426
COMMUNICATIONS 405,	COMMUNICATIONS 412	MUSIC 417, 418	BOOKS
406	CONSTRUCTION412	ONE-OF-A-KIND418	BUSINESS
COMPUTER SYSTEMS 406, 407	DATA BASE412	OPERATION SYSTEMS . 418	OPPORTUNITIES
DISK DRIVES 407	DATA ENTRY 412, 413	PREVENTATIVE	CATALOGUES426
DISKETTES 408	DATA	MAINTENANCE 418	COMPUTER INSURANCE 426
EXPANSION	MANAGEMENT	PROGRAMMERS TOOLS	COMPUTER LEASING
UNITS 409	DESKTOP PUBLISHING 413		COMPUTER SERVICES
MONITORS		PUBLIC DOMAIN 420	CONSULTANTS
PERIPHERALS 409, 410	EDUCATION 413, 414	REAL ESTATE420	
PLOTTERS	ENGINEERING 414	RELIGION 420	CONVERSION SERVICE DATA
POWER	GAMES	SALES MARKETING420, 421	CONVERSION
PROTECTION			DIGITIZERS
POWER SUPPLIES 410	FINANCIAL 415	SCIENTIFIC	DISK CONVERSION 427
PRINTERS 410	FLOWCHARTING416	SECURITY 421, 422	DISKETTE COPY
SECURITY 410	GENERAL416	SERVICES	SERVICE 427, 428
SPEED DEVICES 410	GRAPHICS 416	SHAREWARE422	EMPLOYMENT OPPORTUNITIES
SOFTWARE	HEALTH416	STATISTICS422	FURNITURE
ACCOUNTING411	INVENTORY 416	TAXES	MAILING LISTS 428
	LANGUAGES417	TERMINAL.	NETWORKING 428
ARTIFICIAL INTELLIGENCE 411	LEGAL	EMULATION	PUBLICATIONS
BACKUP SYSTEMS	MAILING PROGRAMS	TRAVEL	SUPPLIES428, 429
BUSINESS 411, 412		UTILITIES 423, 424	TRAINING/TUTORIALS. 429
BUSINESS PROJECT	MANUFACTURING 417	WORD	TYPESETTING429
MANAGEMENT 412	MEDICAL417	PROCESSING 424, 425	USED EQUIPMENT

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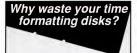
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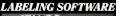
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ADVERTISERS PRODUCT INDEX

RS#		OUCT	PAGE# RE			OUCT	PAGE
	EALOGY SOFTWARE			VORE	PROCESSING SOFTWA	ARE/AIDS	
375	Data Access Corporation	Office Works	177 21	18	Bitstream	Fortware Relational Reportwriter	19
ACC	OUNTING SOFTWARE		31	15	Concentric Data Systems	Manuscrot	9
185	Aptech Inc Bedford Software Limited	Abrasas	304		Lotus		25 25 5/W 1
185 482 194 220 200 263 358 470 197	Bedford Software Limited	Abrasas Accounting Software Accounting Software Accounting Software	346 30 316 50	32	Micro Com Systems Microsoft	Multifunction Pub Domain	S/W 11
194 220	Cougar MT Software DAC Software	Accounting Software	315 50 69 73 21 51	38	Turner Hall Publishme	Microsoft Press. 4 Word Word Processing Software	30
500	Integrated Information Service		21 51	13	Wordoerfect Corporation	Word Processing Software	302-300
263	Macola Inc Peachtree Software			18	Xyquest Zytab Corporation	XYWrite III Plus Word Processing Software	
358 470	SBT Corp	Accounting Software Database Accounting Libr				Word Processing Sonware	
197	Sohdisk, Inc	Accounting		AD/C			
DESI	K TOP ORGANIZERS		47	75	American Small Business Comp Autoriesk	Cad Software Autosketch Cad Software Cad Software	29
137	Borland International	Sidekick Plus	55 19	80	Foresight Resources Inc.	Cad Software	35
	ABASE MANAGERS	CHISTON 100	50	06	Generic Software Inc	Genenic Cadd	35 24
				DOE	ADSHEET/TEMPLATES		
138 494 281 315 161 148 176	Borland International Buffcoware	Paradox			Computer Associates	Silverado	27
781	Computer Associates			39/190			
15		Relational Reportwinter	98 ·		Microsoft	Excel	C5
61	Data Access Corporation Defact			53	Personal Computer Support Personics Corp	Can Mare	12-1
76	Microsin	Detast . Rhase			Personics Corp	See More	33
	Dracie	Database Management Sc	tovare 49 D	ECK	TOP PUBLISHING		
443 770		Database Management Sc Letter Master Database Accounting Libr	354				
	SBT Corp	Usualing Accounting Liter	iry20 21	35	Bitstream IMSI	Fortware Page Perfect	19
	SYSTEMS & ACCESS ME				Dandu	Page Perfect Desk Top Organizer	
76	Micro Com Systems	Multifunction Public Dom Goter	en S/W 344 345	ATA	ENTRY SOFTWARE		
26 05	Microlytics Support Station	Goter Electric File Cabinet	267 D		Form Work Inc.	Form Work	
		CIOCOL FIRE CALVIES					······································
INFO	RMATION MANAGERS				NSTRATION SOFTWAR		
315	Concentric Data Systems Lotus	Relational Reportwriter Agenda		35	nView Corporation	View Frame	321
	Lotus		145 E	DUC	ATIONAL SOFTWARE		
	Lotus		149 19	97	Solidisk, Inc.	Education	
105	Micro Com Systems	Multifunction Public Dom	ın SW 16	MTE	RTAINMENT SOFTWAR	F	
NTE	GRATED SOFTWARE		10		Solidisk, Inc	Entertainment	
	Informix Software Inc.	Integrated Software	112-115			Citiza Sanaratic	
163	Software Group, The	Enable	37		DESIGNERS		
LAN	GUAGES		33	32	Form Gen Corporation	Form Generating Software	4
377	Borland International	Turbo C	57		United Systems	Form Software	25
31	Microway	Fortran Compiler			ATIBLE KEYBOARDS		
OPE	RATING SYSTEMS ENVI	RONMENTS	12		Zeos International	Compatible	39
393	Software Link, Inc.	PC-MDS/386	122-123 B	ACK	UP SOFTWARE		
DDA	GRAM DEVELOPERS GE		45	85	Westlake Data Corp	Back Up Software	35
52	Clarion Software		70 D	HSK	BACKUP & TAPE DRIVE	S	
96	Nantucket Corp.	Clipper	373 52		Acchive	Back Up	9
200	JECT MANAGEMENT				Compact Disc Products		
49	Symantec Corp Breakthrough	Timeline	63 33	86	Fifth Generation Iomega Corporation	Fast Back Plus Bernouelli Box II	
95	Installan	Project & Presenta Mgmt	System 285 19			Floory Disk	
87	Primavera Systems	Primavision 3	System 285 15 270 11	13	Victor Enterprises Technology	Floppy Disk Diskette Duplicator	
STA	TISTICAL SOFTWARE		H	IARD	DISKS		
	SPSS, Inc STSC	SPSS PC+	116 22	25	Core International	Networking Version	17
139 156	ŠTŠČ	Stat	229 34	41		Networking Version Hard Disk Drives 115-1144 KB Lanstor Subs	34
TEV	TEDITORS			76	Storage Dimensions Maxtor Tandon Corp	115-1144 KB Lanstor Subs Data Pac	lystem 10
I RR	Command Technology Com	505.00 2.0				Vesa / es	230-23
84	Command Technology Corp. Candu	SPF/PC 2.0. Desk Top Drganger	81 <u>C</u>		UTERS/COMPATIBLES		
ITH	ITIES		55 48	42	AST Research	PC Compatible	224-22
137	Borland International	Sidekick Plus	55 48	/5	Bentley Computers Building Computer Products	Diene PC's Computer Accessories	310-31
160	Central Point Software						
150	Central Point Software	PC Tools Delune Calendar Creator Plus	74 27	79			130-13
151	Channelmark Clarion Software	Calendar Creator Plus Clarion	325 16	22	Computer Products United Dataworld		
120 151 152 115 148 186 186 180 110 117 189 182	Concentric Data Systems	Relational Reportwriter	98 21	16	Evertx Systems, Inc.	PC Computer Systems Div-38t PC Compatibles PC Compatible Computers PS/2	5-20 285-28
43	Dbfast		383 38	56	Five Star Electronics, Inc.	PC Compatibles	358-39
200	Fifth Generation	Fast Back Plus	76 12	24	Hyundai IBM Corp	PC Compatible Computers	32
in	Golden Bow Systems Hammerly Computer Services, In	V-Dot Pro Bes Multifunction Public Dom Utilities	333 38	52		PS'2 Clone Computers PC's Compatible Compatible PC Compatibles	294-29
302	Micro Corn Systems	Multifunction Public Dom	an SW 16 10	02		PC's Compatible	29
10	Nasdec Network Enhancement Tools	Network Utilities	378 37 272 53	77	PC Designs Dell Computer	Companole	102.10
89	Personal Computer Support			56			
282			17 35	90		386/286	
	Personics Corp		332 25 356 28	54	Sun Microsystems Tandy Radio Shack		
197	Rose Electronics	Passport	356 25	51	Televideo	Companible Computers Tel Oas	
334	Softdisk, Inc. Softlaga Solutions	Disk Optimizer . Disk Optimizer .				Family Ad PC's	306-30
290 197 334 333 121 222 737	Settogic Solutions	Disk Optimizer	255 77 56 30	31	Ven Dex	PC's PC Compatible	28
222	The Aldridge Company Traveling Software Turner Hall Publishing	Tree 85 Lapink	207		Vertex Systems	-t-Lompardie	24
	Torong Mad Datherton	Spelin DWC Usiry	363 11	NPU1	DEVICES		
737	US Global Sync		272 24		Key Tronic	KR\$151/101 Keyboard	

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CIRCLE FOR FREE INFORMATION	N			Vold after September 15, 1988
101 102 103 104 105 106 107 108 109 110 11	11 112 113 114 115 116 117 118 1	19 120 121 122 123 124 125 126 127 128	129 130 131 132 133 134 135 136 137 138 139 140 14	1 142 143 144 145 146 147 148 149 150
151 152 153 154 155 156 157 158 159 160 16	61 142 163 144 145 166 167 168 1	19 170 171 172 173 174 175 176 177 178	179 180 181 182 183 184 185 186 187 188 189 190 19	1 192 193 194 195 196 197 198 199 200
201 202 203 204 205 206 207 208 209 210 2	111 212 213 214 215 216 217 218 2	19 220 221 222 223 224 225 226 227 228	229 230 231 232 233 234 235 236 237 238 239 246 24	1 242 243 244 245 246 247 248 249 250
251 257 253 254 255 256 257 258 259 260 26	61 262 263 264 265 266 267 268 2	89 270 271 272 273 274 275 276 277 278	279 280 281 282 283 284 285 284 287 288 289 290 29	1 292 293 294 295 294 297 298 299 300
301 302 303 304 305 304 307 308 309 310 3	111 312 313 314 315 316 317 318 3	9 320 321 322 323 324 325 326 327 328	329 330 331 332 333 334 335 336 337 338 339 340 34	1 342 343 344 345 346 347 348 349 350
			379 380 381 382 383 384 385 384 387 388 389 390 39	
			429 430 431 432 433 434 435 436 437 438 439 440 64	
			479 480 481 482 483 484 485 486 487 488 489 490 49	
			529 530 531 532 533 534 535 536 537 538 539 540 54	
			579 580 581 582 583 584 585 586 587 588 589 590 59	
			629 630 631 632 633 634 635 636 637 638 639 640 64	
			679 680 681 682 683 684 685 686 687 688 689 670 69	
			729 730 731 732 733 734 735 736 737 738 739 740 74	
			779 780 781 782 783 784 785 784 787 788 789 790 79	
			829 830 831 832 833 834 835 836 837 838 839 840 84	
851 852 853 854 855 856 857 858 859 860 B	61 862 863 864 865 866 867 868 8	69 670 871 872 873 874 875 876 877 878	879 880 861 882 883 884 865 886 887 888 889 890 89	
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151 152 153 154 165 166 167 168 169 110 16	111 112 113 114 115 116 117 118 1 141 142 143 144 145 144 147 148 1	19 120 121 122 123 124 125 126 127 128 40 170 171 171 173 174 175 176 177 178	129 130 131 132 133 134 135 136 137 138 139 140 14 179 180 181 182 183 184 185 184 187 188 189 190 191	1 142 143 144 145 146 147 148 149 150

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101 102 103 104 105 106 107 106 10	9 110 111 112 113 114 115 116 117 118 :	119 120 127 122 123 124 125 126 127 12	1 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 1	17 148 149 150
151 152 153 154 155 156 157 158 15	9 160 161 162 163 164 165 166 167 168 1	169 170 171 172 173 174 175 174 177 171	\$ 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 1	77 199 199 200
201 202 203 204 205 206 207 208 20	9 210 211 212 213 214 215 216 217 218 :	219 220 221 222 223 224 225 226 227 22	1 229 230 231 232 233 234 235 234 237 238 239 240 241 242 243 244 245 246 2	17 248 249 250
251 257 253 254 255 256 257 258 25	9 260 261 262 263 264 265 266 267 268 3	269 270 271 272 273 274 275 276 277 271	1 279 280 281 282 283 284 285 284 287 288 289 290 291 292 293 294 294 294 2	77 298 299 300
301 307 303 304 305 306 307 308 30	9 310 311 312 313 314 315 316 317 318 :	119 320 321 322 323 324 325 326 227 32	329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 3	7 348 349 350
351 352 353 354 355 356 357 358 35	9 360 361 362 363 364 365 366 367 368 3	M9 370 371 377 373 374 375 374 377 37	379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 3	17 100 300 400
401 402 403 404 405 406 407 408 40	9 410 411 412 413 414 415 416 417 418	119 420 421 422 423 424 425 426 427 428	427 430 431 432 433 434 435 436 437 438 437 440 441 442 443 444 445 446 4	C 445 449 450
451 452 453 454 455 456 457 458 45	9 460 461 462 463 464 465 466 467 468 4	167 470 471 472 473 474 475 476 477 477	8 477 480 481 482 483 484 485 484 487 488 489 490 491 492 493 494 495 496 4	17 400 400 500
			8 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 5	
551 552 553 554 555 556 557 558 59	9 560 561 562 563 564 565 566 567 568	549 570 571 572 573 574 575 574 577 57	8 579 580 581 582 583 584 585 584 587 588 589 590 591 592 593 594 595 594 9	17 999 599 400
			627 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 6	
651 652 653 654 655 656 657 658 65	9 660 661 662 663 664 665 666 667 668 6	169 670 671 672 673 674 675 676 677 671	R 679 680 681 682 683 684 685 684 687 688 689 689 681 682 683 684 685 686 68	17 440 469 700
			779 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 744 7	
			779 780 781 782 783 784 785 784 787 788 789 790 791 792 793 794 795 794 7	
			829 830 831 832 833 834 835 834 837 838 839 840 841 842 843 844 845 844 8	
851 852 853 854 855 856 857 858 85	9 860 861 862 863 864 865 866 867 868 1	569 870 871 872 873 874 875 876 877 8 7 1	8 879 880 881 882 883 884 885 884 887 888 889 890 891 892 893 894 895 894 B	27 999 999 900
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50	Microsoft Mouse Systems	Microsoft Mouse C8 PC Mouse 170	532	DCA FOX Gareway Communications	10 Net
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7	GRAMMERS TOOLS L		MOD	EMS	
-	Hammerly Computer Services, In	Don Day 222	136 507	Hayes Microcomputer Products	Moderns 230
	Nantucket Corp.	Dinner 373	231	Natural Microsystems Touchbase Systems	Watson Modern
	Programmer's Paradise	Programming Tools	364	Ven-Tel	Moderns
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		PS/2 Board 178-179 Bodard Promo 175	366	Persoft	Term. Emulator ba-Terrs. Emulator
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	Sigma Designs	VGA Board 294 Add-in Memory Board 324	DISE	3M Data Recording Products Div	Magnetic Media
	Sigma Designs STB Systems Thomas-Conrad Corp	Add-in Memory Sound 324 Add-in Sound 333	271	Sony Corporation of America	Pioppy Oskettes
	NERS DIGITIZERS				1497 00000
*		Scanners 165		ER PROTECTION	
	Chinon The Complete PC	Complete Personal Commu Family 235	149	American Power Conversion Corp Emerson Electric Co.	UPS 202
Ñ	TERS		272	Kensington Microware Ltd	Power Protection
-	Buffale Products	SX Peripheral Sharing Device	381		
		Printer	473	PC Cooling Systems	Power Supplies
	Hewlett Packard-Peripheral Gro	Printer 198-199 Scanjer 244 Scan Jet 245 Laser Printer 347		CCESSORIES	
	Hewlett Packard-Peripheral Gro Panasonic Computer Division	Laser Printer 245	204	Avery	PC Accessories
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	Personal Computer Support	Breakthry	301		Mai Driter
м	MUNICATIONS SOFT	WARE	305		Mail Order
_	Digital Products	Net Commonder 53	535	PC Correction PC Network (Formerly IMT)	Mail Drofer 206 Mail Order Epson
	Equinox Systems Inc. Mendian Technology		355	PC Petrop (Formerly Int I)	Epson .
	Mendian Technology	Carbon Copy Plus			
	Rose Electronics Traveling Software	Passport 356 Lagink 307	184		Mai Droer
	LAREA NETWORKI		123	Silicon Specialties Softine	Mail Order Mail Order
<u>,,</u>	1COM	3COM 3 + Networks 274-275	274 206 512	Suntranics	Mail Order
	A S.P. Communiter Products	3 COM 3 + Networks	206	Teenart	Mail Order 4 Mail Order 4 Mail Order
	A S.P. Computer Products Alloy Computer Products AST Research	PC Plus 197	512 268	The Computer Warehouse Tursies Computer Products	Mail Order 6
	AST Research	AST Ethernet	171	Tussey Computer Products Warehouse Oata Products Whole Earth Computer	Mail Order
	Axon Buffalo Products	SX Peripheral Sharing Device 183	528	Whole Earth Computer	Mail Order
	Businessland	Compac Connectivity	DIR	ECT MARKETING CONN	ECTION
	Core International DCA/Crosstalk Communications	Networking Version	521	Emercan Seminanturtor	Mail Dister A/O
	DCA/Crosstalk Communications DCA/FOX	Mark 4		Arrington Computer Products	Mail Order 390
	Digital Products	Net Commander	172		Mail Deder
			135	Bus Computer Systems Computer Discount Warehouse	Mail Drder
	Gateway Communications DSC Granger	Lan Gateway 101 Local Area Network 104-105	263		Mail Droter
		Local Area Network	346	Jameco Fiectronics	Mail order
	Network Enhancement Tools Novell Inc.		108 387	JDR Micro Devices MN Warehouse	Mail Order
	Oron	Lan			Mail Droter
	Orion Pure Data	Arc Net 329	162 535	ORC Technologies PC Network	Mail Order Mail Order
	Rosa Electronics	Masterswitch		PC Network PC Pestro	Mail Order Mail Order
	Software Link, Inc. Standard Microsystems Com.	Lavink SX	184 274	Shamrook	Mail Droter
	Standard Microsystems Corp Thomas-Conrad Corp	Add- in Roard 303	274 \$12	Surtrones	Mail Order Mail Order
	Toos	Connectivity 60-61	\$12 121	The Computer Warehouse Zeos International	Mail Order
=	Torus Systems, Inc	Tapestry 8			
ń	AST Research			KETPLACE	
		AST Ethernet	742	US Global Sync	DWC Usiny



EDITORIAL PRODUCT INDEX

READE SERVIC HUMBI	R F P PRODUCT	COMPANY	PAGE	READER SERVICE NUMBER PRODUCT	COMPANY	PAGE	READER SERVICE NUMBER	PRODUCT	COMPANY	PAGE
ACC	OUNTING SO	FTWARE		672 Right Hand Man	FutureSoft Inc.	235	_		Associates Inc.	
449	Dac-Easy Light	Dac Software Inc.		571 Shoebox 3	R+R Associates Inc.	240	665	E-Monitor	Westcon	252
	HIN BOARDS	Date Commercial		670 Workstation	Leader Systems Inc.	242			Associates Inc.	
			—I.	Wizard			664	EtherProbe	3Com Corp.	254
443	Microspeed PDA	Microspeed Inc.	52	CONNECTIVITY:	NETWORK	_	663	LAN MAP	Computer	255
444	Drchid RamOuest	Orchid Technology	52	OPERATING SYS	TEMS				Communication Co.	
	Extra		18	699 EasyNet	EasyNet Systems	135	662	LANtrail	LAN Services Inc.	257
AFT	ER HOURS			- Ludyiiii	Inc.	100	661	LANWatch	FTP Software Inc.	262
667	CompuServe	CompuServe Inc.	438 6	598 LANtastic Netwo	rk Artisoft Inc.	135	660	LT Auditor	Blue Lance	264
668	GEnie	GE Information	440	Operating System			659	Network Assistant	Pacific Software	270
		Services		597 LifeNet	Univation	144	DAT	BASE MANA	CEMENT	
669	The Source	Source		695 Network-OS	CBIS Inc.	148				
		Telecomputing		894 Omninet PC/NO:		150	448	Paradox 386	Borland International	33
		Corp.		893 PC Local Area	IBM Corp.	154	GRA	PHICS		
CAL)		— I.	Network Program 596 SFT NetWare 2.		156	432	Pine	Zenographics Inc.	48
436	DesignCAD 3-D	American Small		692 Tapestry	Torus Systems Inc.	164	438	V-RAM VGA	Video Seven	51
100	DOJIGNO D' D	Business		441 Tapestry II	Torus Systems Inc.	151		DISKS		
		Computers Inc.	- 12	991 1DNET	10NET	171				
COL	APUTERS				Communications		442	Miniscribe Model	Minisonibe Corp.	51
			16	890 3+Share	3Com Corp.	172		3085		
440	Astrid 286/20 CAE/SAR 386II	Astrid Computers	51	598 TOPS	Sun Microsystems	176	SOFT	TWARE		
433	CAE/SAH 386II	CAE/SAR Systems	46		Inc.		430	GrandView	Symantec Corp.	34
445	Citizen Mate/12	Inc. Citizen America	52 6	588 ViaNet Networkii		180	446	Time Line	Symantec Corp.	54
412	CHIZEH MALE/12	Corp.		Operating System			440	Version 3.0	Syntamiec Corp.	34
447	Del System 100	Dell Computer Corp.		587 VINES	Banyan Systems Inc.	182	-			_
447	Dell System 220	Dell Computer Corp.	33 (CONNECTIVITY:	NETWORK		SPRI	ADSHEET A	VALYSIS	
447	Dell System 310	Dell Computer Corp.	33 9	UTILITIES			435	JetFont 123 Font	Computer	54
431	Everex STEP 386/	Everex Computer	38 8	566 ARC-Monitor Ptu	s Westcon	248		Cartridge	Peripherals Inc.	
	20	Systems Division	-							
437	Tandy 5000 MC	Tandy Corp.	52 -							
439	Vector Excalibur	Vector Computer		PRODUCTIVITY						_
_	286	Corp.	19	DEPARTMENT	PROGRAM NAME DESCRIPTO	DIN				PAG
	INECTIVITY: N			PC Lab Notes	Create graphics like ani					279
APF	LICATION PRO	DGRAMS		Utilities	COMPARE finds differe					297
686	cc:Mail LAN	PCC Systems Inc.		nvironments	Faults in IBM version of					321
	Package			Power Programming	MASM routines that co					335
585	Command	Spectre Software		Spreadsheet Clinic	Trapping Ctr1-Break to					349
	Performance			Spreadsheet Clinic Spreadsheet Clinic	Macro that converts no Storing a lookup table a					350
684 683	CompareRite	Jurisoft Inc.		Spreadsheet Clinic	Adjusting 1-2-3's calcu					350
003	The Coordinator	Action Technologies Inc.		User-to-User	PRNBYLIN takes over 6					353
882	Direct Net	Delta Technology		Private User	Microspaced proportio					361
	Direct rept	International Inc.		Power User	Creating multiple version					36
002	ForComment	Broderbund	212 F	Power User	Accessing specific field					361
-		Software Inc.		Power User	Ouickly drawing horizo	ntal lin	es of any	length or number in	WordPerfect.	363
-	rotcomment			Power User	Using ProKey to speed					363
581	Higgins	Conetic Systems			Microsoft Word macro	for pri		ry page in the curre		365
581 580	Higgins		214	Power User						
581 580 579	Higgins LANBatch	Conetic Systems Inc. KeyLogic Inc.	214	anguages	Double-precision math					
581 580 579 578	Higgins LANBatch LANscape	Conetic Systems Inc. KeyLogic Inc. Ncompass	214 217	Languages Languages	Double-precision math Tricking Turbo Pascal i	nto lett	ing functi	ons return structur	ed types.	367
581 580 579 578 577	Higgins LANBatch LANscape Lanscope	Conetic Systems Inc. KeyLogic Inc. Noompass Connect Computer	214 217 218	Languages Languages Languages	Double-precision math Tricking Turbo Pascal i Turbo Pascal EGAGR	nto leti RPH de	ing functi monstrat	ons return structures fast point plottin	ed types. g of EGA graphs.	36
581 580 579 578 577 576	Higgins LANBatch LANscape Lanscope Le Menu	Conetic Systems Inc. KeyLogic Inc. Noompass Connect Computer Bartel Software Inc.	214 217 218 223	Languages Languages Languages PC Tutor	Double-precision math Tricking Turbo Pascal i Turbo Pascal EGAGi Using WordPerfect to d	nto lett RPH de create p	ing functi monstrat oure-ASC	ons return structur es fast point plottin Il files that DEBUG	ed types. g of EGA graphs. will accept.	361 361 371
581 580 579 578 577 576 675	Higgins LANBatch LANScape Lanscope Le Menu Magic Menu	Conetic Systems Inc. KeyLogic Inc. Ncompass Connect Computer Bartel Software Inc. Deere Soft Inc.	214 217 218 223 226	Languages Languages Languages PC Tutor PC Tutor	Double-precision math Tricking Turbo Pascal i Turbo Pascal EGAGR Using WordPerfect to o Amount of time it is sal	nto lett RPH de create p le to les	ing functi monstrat ours ASC ave a PC a	ons return structur es fast point plottin Il files that DEBUG v ind its hard disk rur	ed types. g of EGA graphs. will accept. ming.	36: 36: 37: 37:
581 580 579 578 577 576 575 574	Higgins LANBatch LANScape Lanscope Le Menu Magic Menu NETmanager	Conetic Systems Inc. KeyLogic Inc. Noompass Connect Computer Bartel Software Inc. Deere Soft Inc. Brightwork Software	214 L 217 L 218 L 223 F 226 F 228 F	Languages Languages Languages PC Tutor PC Tutor PC Tutor	Double-precision math Tricking Turbo Pascal i Turbo Pascal EGAGl Using WordPerfect to o Amount of time it is sal An Intel 8087 can work	nto lett RPH de create p to les with a	ing funct monstrat ours ASC ave a PC a NEC V20	ons return structur es fast point plottin Il files that DEBUG v ind its hard disk rur and not just with a	ed types. g of EGA graphs. will accept. ming. n Intel 8088.	361 361 371 371
681 680 679 678 676 675 674 673	Higgins LANBatch LANscape Lanscope Le Menu Magic Menu Magic Menu The Network	Conetic Systems Inc. KeyLogic Inc. Ncompass Connect Computer Bartel Software Inc. Deere Soft Inc.	214 217 218 223 226 228 232	Languages Languages Languages PC Tutor PC Tutor PC Tutor PC Tutor	Double-precision math Tricking Turbo Pascal i Turbo Pascal EGA_GR Using WordPerfect to c Amount of time it is sal An Intel 8087 can work Putting NUMLKOFF.CE	nto lett RPH de create p ie to les with a OM in t	ing functi monstrat ours ASC ave a PC a NEC V20 he AUTDE	ons return structur es fast point plottin Il files that DEBUG v and its hard disk rur and not just with a EXEC BAT turns off	ed types. g of EGA graphs. will accept. ning. n Intel 8088. NumLock at bootup.	36: 36: 36: 37: 37: 37: 37:
581 580 579 578 577 576 575 574	Higgins LANBatch LANScape Lanscope Le Menu Magic Menu NETmanager	Conetic Systems Inc. KeyLogic Inc. Noompass Connect Computer Bartel Software Inc. Deere Soft Inc. Brightwork Software	214 217 218 223 226 228 232	Languages Languages Languages PC Tutor PC Tutor PC Tutor	Double-precision math Tricking Turbo Pascal i Turbo Pascal EGAGl Using WordPerfect to o Amount of time it is sal An Intel 8087 can work	nto lett RPH de reate p to les with a DM in to CGA wi	ing functionstrate ourse ASC ave a PC a NEC V20 the AUTDE ten programment of the programment of the AUTDE of	ons return structur es fast point plottin Il files that DEBUG v and its hard disk rur and not just with a EXEC BAT turns off ams write directly b	ed types. g of EGA graphs. will accept. ning. n Intel 8088. NumLock at bootup. o video memory.	361 361 371 371

COMING UP

386 HUSTLERS ARRIVE. The first wave of 20-MHz 360 mechines has hit the market. Not surprisingly, the increased competition is working the same magic in the 386 world as it did when 286 competitons began challenging the IBM PC AT. Prices are coming down while innovation is increasing the power and flexibility these machines put at your fingertips. In this, our first translup of 20-MHz computers, we put these challengers to the test. Courthouing colder Wim L. Rooch beads Courthouing colder Wim L. Rooch beads ALR. Core, HEI, HP, IDR, Logits, Micro I, Milker, Protests, and VIPC.

DESKTOP PUBLISHING TIPS
The desktop publishing package you are using gives you all the tools you need to create using gives you all the tools you need to create using reports and presentations. It's up to you to toue those tools to show off your to you can be used to you chook as borders, and the logors you place on the page affect the look of the document you produce. In this report, our desktop publishing experts, Diame Burns and S. Venit, tell you have a greater you chook as the page affect the logor publishing experts. Diame Burns and S. Venit, tell you have a greater you treasketters, you want to have the best light.

GETTING THE FAX Fax is the fastest way to transmit images across town or across the world. Fax machines are becoming as common as watercoolers, and now PC fax is challenging those standalone machines. PC fax's combination of board and software can zing documents from your hard disk to any of the 1 million fax machines in the United States in a matter of minutes, PC Labs developed a whole new suite of benchmark tests for this review of ten PC fax systems. Our team tells you what we learned about these systems: GammaFax, JT-Fax, MicroFax, Complete Fax Board, XaFax, EZ-Fax, Smartfax, Fax Partner, Beyond Fax SPC-1, and Fax Mail 96.

PRODUCTIVITY Looking for a way to toggle off the hotkeys of your TSR programs? Then check out ALLKEYS in next issue's Utilities column.

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AFTER HOURS

CB Simulators

6 and 15 are for people who want to discuss things related to France or Spain. Young adults on 7 are usually between the ages of 17 and 25, while the teen channel is reserved for the skateboard and surfboard set, with lots of overlap. The Flamingo Lounge on channel 16 is a vuppe bar. The Porch on 34 is

less frenetic—more like the corner café. Senior citizens can gather on channel 22. The Knights of Olde is a place for games like Dungeons and Dragons. Channel 13, the Gender Alternatives channel, is for transvestites and transsexuals. Channel 33 is for gay men.

Having a real discussion on the open channels is like talking in a crowded bar. When you see someone interesting, you can

use the /Talk command to request a private conversation. Occasionally someone will sign on with a handle indicating that he is the system operator or an official of CompuServe and will

start giving orders.
Neither CompuServe nor the two other services monitor your conversations. They issue warnings only after receiving complaints about the language or behavior of a participant; as a

last resort they will disable your account and bar you from using the service.

CompuServe cannot monitor private talks or encrypted conversations. In those rare cases when it's necessary to warn a user abusing an open channel, LooLoo, the real system operator, will come on the line. You'll know that it's Loo-Loo because her message will not be preceded by a handle;

Just Another Night on The Source. . . Conversations on The Source range from the whimsical through

the political to the downright bizarre. Here's a sampling from a recent evening's worth of The Source chat.

[61*AL*: Would anyone here believe that my life is simi-

lar to Opus'?

[6]MACBETH: Everyone's life is similar to Opus's.
[6]SUE: who is opus?

[6]*AL*: Except I'm not a waterfowl.

[6]MACBETH: Opus, fortunately, is a model of how to accept the bitter and remain sweet.

[6]*AL*: Opus is a waterfowl.
[6]*AL*: Or accept the sweet and remain bitter

[6]*AL*: <grin> [6]SUE: i know a medel like that

A little about the mechanics. On The Source, each line begins with a number and the name of the perion who "said" in The names are not necessarily the relat names of the participants, and the period of the period of the period of the participants, and period of the several other groups 2 toold have pixed, including a political roundable attended by four participants. Typing the command STATUS (all Source commands begin with a minus sign STATUS (all Source commands begin with a minus sign start of the period of the period of the period of the period of the each. Typing anything that doesn't begin with a minus causes the text to appear on the reterned all the other participants.

Here's what -STATUS showed:

Title (Joined/Viewing/Notify)

1 CHITCHAT (3/0/0) 2 FEBRUARY CHATS (0/0/0)

3 NEWCOMER'S CHAT (0/1/0) 4 PARTI WELCOME CHAT (3/0/0) 5 POLITICAL ROUNDTABLE (4/0/0)

6 LET'S CHAT (7/0/0)

Sue, Al, Macbeth, and I weren't alone: seven people were joined to the chat, the other three participants choosing to remain silent—or perhaps they were fixing a snack.

silent—or perhaps they were fixing a snack.

It's not necessary to wait for a lull in conversation to join in.

At the same time Sue wondered about Opus's identity, I gath-

ered my wits and posed the same question. When I pressed the Return key, the message "(IsQACE: who 's the opps dude?") appeared on the screens of the other chatters, but was not echoed on my own. Ace was the handle I had selected when I logged on, and it was to prove a numerankable choice. Later I got some lessons in picking a name for myself. (See the sidebar "What's Your Handle?")

Occasionally the socializing takes a bizarre turn. Consider this dialog among Ronald Reagan, Nixon, and Gorbachev. I wonder if the Washington/Moscow hot line is this interesting.

[6]NIXON: budget? screw the homeless!

[6]RONALD.REAGAN: We must vote me out of office!!!! 16IGORBACHEV: We are asking you not to nuke the

people's recovery centers, because in doing so, you are screwing up entire soviet packaging industry. [6]SUE: do you guys realize how much you're paying to

do that? {smile} [6]RONALD.REAGAN: Da, da gorbackeves having der

caviars.

[6]NIXON: Forget Cuba . . . let's invade england

[6]RONALD.REAGAN: Nixon, you nose!

[6]RONALD.REAGAN: WATERGATE [6]NIXON: geeze

[6]SUE: ha! [6]RONALD.REAGAN: WATERGATE [6]AMSEL: Arg!

[6]RONALD.REAGAN: (that'll make nixon run)

[6]AMSEL: I'm tired of line noise!!!!
[6]SUE: hang up and call back if it gets bad amsel.
[6]BLACKFORD: Get back to basics or Sue and I are go-

ing to leave and HOT-CHAT!

When someone gets obnoxious you can enter the -REJECT command, and none of that person's transmissions will appear on

mand, and none of that person's transmissions will appear on your screen. Alternately, you can reject the entire group and talk privately with anyone who agrees to join you. This is what Blackford has suggested, although Sue seems in no hurry to leave.

Meanwhile, Amsel complains of telephone line noise garbling the messages on his screen. That's the computer equivalent of someone playing the TV too loud when you're trying to talk on the phone.—Donald B. Trivette only LooLoo can talk without a handle before her message. Her badge is her bell—only she can send a message that will ring the bell on your PC. So if you hear a beep and see a warning without a handle, pay attention—it's for real.

You may wonder whether anyone can find out your real name and address. Loo, Loo says no. That information is not available on-line, and Compuserve, like the other services, never gives it out. But remember, she warms, CB is a close knit group. If you give your name and address to just one indiscrete person, it might get out to others.

CB is a great way to make new friends and meet interesting people that you otherwise might not engage in conversation. For the deaf and the homebound, it's a chance to mix and make friends on an equal basis; for the foreigner who wants to learn colloquial English, there's no better way.

Bonu on the CB. My handle? Never mind. I like to be anonymous too.

CompuServe (for pricing, see the table "On-line CB Simulators"). Requires: Computer, modem, communications software, and membership. CompuServe Inc., 500 Arlingston Centre Blvd., P.O. Box 20212, Columbus, OH 43220; (800) 848-8199.

CIRCLE 667 ON READER SERVICE CARD

ON-LINE SERVICES

Play Among the Stars With Astroforum on CompuServe

BY C. E. L. STARK
CompuServe members can turn
their PC screens into deep-space
windows with a few keystrokes
by typing GO ASTROPORUM
at the CompuServe! prompt.
Digitized pictures from the giant 200-inch Mount Palomar
telescope and America's Voyager Il spacecraft can be downloaded and displayed on either
CQA, EGA, VQA, AT&T. or
CQA, EGA, VQA, AT&T. or

PCir screens.

The picture of the spiral galaxy M101 (shown above right) is but one of the many shots that have been uploaded by Astronomy Forum members. Located in Ursa Major, about 300 million light years away, M101 is a head-on spiral galaxy of type Sc and magnitude +8. Other exciting photographs on the Forum range from a close-up of Jupiter's red spot and its Galilean moons to the mysterious Horsehead nebula and a radiograph of a supernova remnant in Cassiopeia, taken with a radio telescope and analyzed by a CRAY

supercomputer.

If you are already a Compu-Serve subscriber, joining Astro-



Spiral galaxy M101, part of Ursu Major, as depicted on Astroforum. The image is a digitized version of a photograph taken by the Mount Palomar telescope.



tronomical information and participate in discussions with other members.

forum costs nothing beyond | your normal CompuServe charges. The pictures in the astrophotography download area are encoded in the GIF (Graphics Information File) data format. Once you have downloaded the pictures you want, you'll need a program to convert this format into something your video display can handle. The SHOWGIF. EXE program. which can be downloaded from the PICS forum, translates the GIF format for CGA, EGA. AT&T, and PCir displays and will automatically take advantage of your screen's capabilities. If you're using a VGA, I suggest trying VGAGIF.ARC

or FASTGF.ARC, both of which are also available in the PICS forum, download area 1. Quite apart from its pictures,

Astroforum is a valuable source of information for anyone interested in astronomy. Forum subdivisions include Astro-happenings, Telescopes/Hardware, Satellite Observing, Deep Sky Astronomy, Astrophotography, Cosmology, and more. The questions I've raised through the forum have been answered promptly and intelligently by knowledgeable users, Possibly the most intriguing aspect of the forum is its series of weekly online conferences with wellknown astronomers and professors, where you can listen in on the question-and-answer session between other users and the speaker.

For CompuServe subscription information, see the on-line CB review in this section.

Tracking Trends in On-line CB Use

Computer CB users span all geographic and demographic strata, but some trends in CB use are emerging. Abraham Maud, who beauting the little of the communications and blorounders Studies us to Content for Telecommunications and blorounders Studies us Columbia Universifications and Lorounders Studies us Columbia Universifications and the Columbia Studies us Columbia Universifications and the Columbia Studies and Columbia Universification and New York, and least popular in Montena and Wy-omning; that little many trends, this one began on the two coasts and is nowing toward the South and Middwest.

Maud 15 figures also show that CB contraints with the days and the New York and Studies Stud

Mund's figures also show that CB correlates with the days and times of other leisure activities like watching TV and going to movies and bars. Wednesdays are the least active day for CB, and one o'clock Sunday morning, when East and West Coast users overlap. is the most poular,—Donald B. Trivette

AFTER HOURS

CR Simulators

block, having been founded just a few years ago. GEnie has no assigned groups or channels, so the first order of business is to find the current "in" spot. This is like cruising the neighbor-

hood to see where the party is. GEnie commands begin with a slash, and the /User command shows the activity on all 40 channels.

Unlike The Source, which doesn't tell you who is located where, GEnie shows the location of the participants. Know-

What's Your Handle?

Selecting a good CB "handle," or alias, is important. It's got to be sexy and clever enough to make people want to talk to you but not so provocative that it turns them off or frightens them. Neither Ace nor V-8 (my first two tries) attracted much attention, but after considerable experimentation I found one that

worked for me

Some of the better handles on CompuServe put mine to me; they include Gentle Moose, Ranch Hand, Lady Willing, ybug, sparky-f, StratoCaster, Demon Watcher!!, HOUS-TON KNIGHT, *<<< pushin' it<<*, Good Buddy, *MA-JOR SEVENTH*, Baby Maker, Bill's Monica, Alaska Dan, LADIES SLAVE BOY, *Werewolf*, Film Guy, Dawg in Tears, *Kitten*, Young Blood, USMC D.I., Snowflake! *Lady H.A.M.S.*, But Not Tonight, SwEtsoX, JET JOCK, and *zizzer(19)*. Those handles surrounded by asterisks are reserved for and belong to members of the CB Club, something only CompuServe offers.

A few talented CBers have incorporated graphics in their handles. Flex signs on as !FLEX! and President Aviator includes "-o=O=o-" in the handle, but the most elaborate belongs to a guy who styles himself Spider. When he comes on he prints

> ∧ (o_o) ∧ 11<>11

and there's no doubt who has arrived .- Donald B. Trivette

ing the location of your fellow CBers can be handy if you want to know the weather in, say, Valdosta, Georgia, but GEnie conversations seldom turn to the weather. Instead they are a hodgepodge of fragmented discussions, punctuated with Hellos and Byes and Be-Right-

Backs, among a group of friends who seem to know one another intimately. All three services allow you to monitor several channels at the same time so you won't miss

out on the action, but it's like talking on three phones at once. GEnie promotes the socializing with an on-line newsletter called Muffy's Gossip Column. Anyone can leave an electronic hot tip for Muffy, and she'll run it in her column. Some CBers become regulars; they log on every night and develop genuine friendships. Muffy's colump-yes, there really is a Muffy, I talked with her-is a way for them to exchange experiences and stay in touch.

GEnle (for pricing, see the

accompanying table "On-line CB Simulators** Requires: Computer, modem

communications software, and membership. GE Information Services, 401 N. Washington St., Rockville, MD 20850; (800) 638-

CIRCLE 668 ON READER SERVICE CARD

CompuServe

CompuServe is CB heaven; there are two bands with 40 channels each, although most users seem to like crowding onto band A. One reason CompuServe is so popular is its predefined channels. When you first log on, you are presented with a list showing suggested interest groups and asked which channel you want to tune in.

Each channel has its own clique of regulars and its own tone. Some of the possibilities: The adult channel is a general gathering place; "adult" has nothing to do with the contents of the conversations. Channels

	CompuServe CB Simulator	GEnie LiveWire CB	The Source Chat
Access networks		13	
Telenet	•	. 0	•
Tymnet	•	- O	4 - O -
800	0	1 0 .5	ES 1 .
Proprietary	•	7 %	6-3-6-6
No. of CB channels	72	40	Unlimited .
No. of CB assigned chann	ols 11	None	5-0
Commands		pi -	a continue
No. of commands	40	22	33
On-line help	MELP	MELP	HELP .
No. of users per channel	STATUS	/USE · ·	STATUS
Location of users	/USERS	T ISTATUS	NA -
Assign handle	/HAN	HAN	-ALIAS
Select channel	/TUNE	CHA	JOIN
Monitor several channels	MON	MON	-AIEM
Reject/squeich	/SQU	SQU	REJECT
Encryption	/SCR	SCA	NA
Private talk	/TALK	/PRI	-to
Exit Private mail	EasyPlex	GEmail	SourceMa
Principal rising	Casyries	, OLINGE	
Total no. of subscribers	400,000	94,000	Unavalab
Pricing*			
Sign-up fee	\$39.95	\$29.95	\$29.95
Prime time (300 bps)	\$6 00 hour	\$35.00 ho	
Prima time (1,200 bps)	\$12.50hou		
After hours (300 bps)	\$5.00 hour	\$8.00 hour	
Ather hours (1,200 bps)	\$12.50hou		
Special CB Club rate:	\$100/mont	t+ N/A	NA
	\$1/hour		
	or \$25/mor \$4/hour	10.+	
	SAffour		
Subjective rating			
Social communication	Excellent	Good	Fair
Serious discussion	Fair	Good	Good

INDEX TO ADVERTISERS

RS #	ADVERTISERS	PAGE	RS#	ADVERTISERS	PAGE	RS #	ADVERTISERS	PAGE	RS #	ADVERTISERS	PAGE
238	3 Com	274-275		Dell Computer	165-169	302	MicroCom Systems	16	470	S8T	20
26.7	3M Data	142-143	539	Delt Computer	192-193	526	Microlithic Systems	267	498	Salkosha Corp	388
345	Alloy Computer	157	536	Dell Computer	198-191	178	Micronen	344-345	184	Stamrock	387
140	American Private Convention		241	Decora	196-199	110	Microsoft		131	Stam Flectmancs	
521	American Semiconductor		280	Digital Products	53	509	Moresett	262	252	Siema Designs	204
175	American Small Business	291	743	Digital Research	334	300	Mcrosoft	CS-E	123	Silicon Specialties	80
185	Aptech Inc	384	229	Discount Micro Products	338,331	331	Mcroway	382	107	SoftDisk Inc	7
527	Archive	50	338	DSC Granger	104-105	350	Mouse Systems		197	Softine Softine	84
327	Arinsten Computer	36	157	Emerson Electric Co	202-283	373	Mutch America .	1/0	334	Softings: Solutions	39
	Products	395-391	170	Founda Systems		196	Namucket Corp	219	334	Softogic Soutions	255
230											
	ASP Computer Products	78	216	Everex Systems	288-287	110	Nasdec .	378	394	Software Link Inc	185
142	AST Research		525	Excellitech Inc	333	507	Natural Micro Systems .		393	Software Link Inc	122-123
166	AST Research	125	352	FASTMICRD	42		MEC Home Electronics	138-139	271	Serry Corp	376
165	Autodesk	388	286	Fifth Generation	76	147	Netline	115	390	Spield Computer	58
204	Avery	351	386	Free Star Computer	358-359	117	Network Enhancement	272	139	SPSS Inc	116
395	Axon	181	192	Foresight Resources	355	103	Novel inc	250-251	132	Standard Micro Systems	312
	Bay Express	401	332	Form Gen Corp	46	177	Numerics.	79	517	STB Systems	324
172	Bay Technical Associates	301	174	Form Work Inc	28	195	river	320	476	Storage Dimension Maxor	100
482	Bedford Software	348	146	Gateway Communications	101		Drace	49	156	STSC	229
275	Bentley Computers		256	General Technology		162	Dracle DRC Technologies.	305	100	Sun Micro Systems	151
218	Bitstream	104	506	Generic Software	243	727	Onon Science	328	254	Sun Micro Systems	152-153
125	Bothn Limited	352	369	Golden Bow Systems		119	Parasons	347	274	Suntrones	356
138	Borland	302		ii) GP Technologies	87	319	Paradise Systems	347	105	Support Station	257
138	Borland	62-4	380	U GP rectinologies		339	Paradise Systems	150	249		
377		-1		Hammerly Computer Service	DES 333	381	Para Systems Inc	12	249	Symamec Corp Breakthrough	83
		57	275	Hauppauge Computer	32		PC Brand		232	Tandon	258-259
137	Borland	55	201	Haventree	284	311	PC Brand		289	Tandy Radio Shack	266
328	Buffaio Products	163	136	Hayes Micro Computer	230-231	308	PC Brand	24	206	Telemart	44-45
481	Building Computer	370-371	236	Hewlett-Packard	244	309	PC Brand	25	251	Televideo	389
356			237	Hewlett-Packard	245	301	PC Express	28	121	The Aldridge Co	86
135	Bus Computer System		287	Hub Disk Computer	373	304	PC Express			The Complete PC	235
191	ButtonWare Inc	254	124	Hounda	324	305	PC Express	382	144	The Complete PC	238-237
120	Central Point S W	74		IBM Corp	99.41	303	PC Brand	30	\$12	The Computer Warehouse	396
160	Central Point S W	75	265	IQE Associates	178-179	-	PC Connection .	208-207	259	The Laser Connection	5
151	Channelmark	325	499	IMSI	26		PC Connection	286	363	The Software Group	37
318	Chinna	165	455	Informor Software	112-115		PC Connection	289	486	Thomas-Conrad Corp	333
152	Clarion Software	70	295	Insta Plan Corporation	785	473	PC Cooling Systems		191	TOPS	80-81
188	Command Technologies	252	200	Intergrated Information Sys		372	PC Designs	103	141	Torus Systems Inc	121
26 t	Compact Disc Products		SZR	Intelligrates internationally	175	535	PC Network	346	141	Toshiba	326-327
101	Compaci disc Products	238-238	382	Intelligent Micro Systems		355	PC Priston	347	231	Touchbase Systems	320-327
	Compaq CompuAdd Corp	128	378	Impropert Micro Systems	234-230	358	PL PISTOP	367	231	Touchbase Systems	116
279	Computed Corp	128	243	Iomega	296	356	Peachtree Software Percent	35/	222	Traveling Software	387
		119-177		Jade Computer					737	Turner Hall Publishing	383
320	CompuAdd Corp		346	Jameco	394	366	Persoft	234	738	Turner Hall Publishing	385
518	Computer Accessories	18-19	108	308	386-389	489	Personal Computer Support		268	Tussey Computer	88-67
281	Computer Associates	271	272	Kensington Microware	211		Group	10	729	United Systems	296
109	Computer Discount Warehou	se 480	244	Keytronic	233		Personal Computer Support		742	LIS Giotal	272
183	Computer Mail Order	282-283	193	Kinson Products	263		Genue	11	731	Vendex	286
163	Competer Products United	168-189	341	Lifetime Memory	343	483	Personal Computer Support		354	Ven Tel Inc	14
315	Concentric Data System	98	133	Loostech	340-341		Gran Septon	12-13	329	Writex Systems	246
228	Core International			Lotus		282	Persones Core	17	113	Victory Enterprises	332
194	Cousar Mourtain			Lotus	147	200	Personas Corp		171	Warehouse Data	88-85
126	Crossfalk	82-63		Lotus		187	Persones corp		485		
200		65,03				497	Primavera Systems .	210		Westlake Data	354
220	cures manuscooning	276-278	1	Latus		497	Princeton Graphics	336	528	Whole Earth Computer	386
ceu	OAC Software	89		Lotus	254	335	Programmers Paradise	372	513	Wordperfect Corp.	302-303
375	Data Access	177	263	Macola Inc -	265	322	Pure Data	328	518	Xyquest	281
161	Data Access	241	101	Maghavox	215	384	Qandu Computing	81	325	Zenographics	2.3
	Data World	273	102	May Computer	286	348	Research Development		121	Zeos International	342
148	dBFast	383	228	Mendan Technology	227		Systems	364	316	Zyl.AB Corporation	254
532	DCA Fox	220-221	387	MHI Warehouse	401	290	Rose Electronics	358		Reader Service # Please call a	
531	DCA	165,161		MICROREST	388	298	Samsuno	187		ormation	

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AFTER HOURS



On-line Chat Services Rekindle CB Spirit, Bring PC Users Together

BY DONALD B. TRIVETTE Tired of staring at the TV? Maybe it's time to hook up the modem and log on to one of the CB simulators on CompuServe,

GEnie, and The Source. The CB simulators take their name from the citizens-band radios that were popular a decade ago, but they operate more like the party-line telephone of our grandmothers' day. Instead of talking, however, you type. And instead of chatting with two or three neighbors, you connect with dozens of people around the world.

Here's how it works. Using your computer and communications software like Crosstalk or Smartcom, you dial one of the major information services that provide a CB mode. Compu-Serve, GEnie, and The Source are the three most popular. Once you've given your account code, password, and other preliminaries, you can enter the simulator.

AFTER HOURS

On-line CB Simulators Calling all couch potatoes:

reach out through Compu-Serve, GEnie, and The

Astroforum

CompuServe's on-line service for astronomy buffs has a wealth of information plus colorful images of the universe.

The Source

The Source has the most sober and restrained of the CB services. In fact, it doesn't use the name CB at all, but instead has a more dignified vocabulary: "chat" for "talk," "alias" for "handle," "join" for "channel." "reject" for "squelch." and "view" for "monitor. Rather than tuning a CB channel, you join a discussion

Discussion groups are the strength of The Source, Although there are a few assigned groups, you are encouraged to establish your own. Commands like Banner, Create, and Coordinator are used to set up and run a chat; the chat may be public and open to anyone, or private and restricted to the participants you select. Private chats are often used by business or industry groups as an inexpensive way to conduct a teleconference; public chats are used to win friends, influence people, and socialize.

The Source (for pricing, see the accompanying table "On-line CB Simulators") Requires:

Computer, modern communications software, and membership. Source Telecomputing Corp., 1616 Anderson Rd., McLean, VA 22102: (800) 336-3366

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GEnie is the General Electric Network for Information Exchange. It's the new kid on the



How to Talk CB

CBers have a lingo all their own. Some examples:

b4	before
U	you
bcnu	be seeing you
brb	be right back
cu l8tr	see you later
did you hear	the dots mean there's more to come
go pri	go into private talk
gr8	great
lurk	watch but not participate
morf	male or female?
olc	oh, I see
rehi	hi, again
ru	are you
ur	you are
/wrist	I am depressed
[]	hugs
:)	smiley face (sideways)
;)	winking smiley face (sideways)
<0><->	wink
:(sad face (sideways)
=:0	surprise (sideways)

Since written "conversation" doesn't show whether you are serious or kidding, something is needed to give an indication of your mood; thus, <hornfield looks, (grin), and (smile) punctuate the chatter. Cu l8tr.—Donald B. Trivette

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